Appendices

Appendix A
Glossary

The definitions given are valid as they are used in this publication but different definitions may be used in other contexts. *A Dictionary of Epidemiology*, Second Edition, edited by J.M. Last for the International Epidemiological Association and published by Oxford University Press, 1988, was helpful in providing a number of the definitions.

A

AGE-ADJUSTED MORTALITY RATE. A mortality rate statistically modified to eliminate the effect of different age distributions in the different populations.

AGENT. A factor, such as a microorganism, chemical substance, or form of radiation, whose presence, excessive presence, or (in deficiency diseases) relative absence is essential for the occurrence of a disease.

AGE-SPECIFIC MORTALITY RATE. A mortality rate limited to a particular age group. The numerator is the number of deaths in that age group; the denominator is the number of persons in that age group in the population.

ANALYTIC EPIDEMIOLOGY. The aspect of epidemiology concerned with the search for health-related causes and effects. Uses comparison groups, which provide baseline data, to quantify the association between exposures and outcomes, and test hypotheses about causal relationships.

ANALYTIC STUDY. A comparative study intended to identify and quantify associations, test hypotheses, and identify causes. Two common types are cohort study and case-control study.

APPLIED EPIDEMIOLOGY. The application or practice of epidemiology to address public health issues.

ASSOCIATION. Statistical relationship between two or more events, characteristics, or other variables.

ATTACK RATE. A variant of an incident rate, applied to a narrowly defined population observed for a limited period of time, such as during an epidemic.

ATTRIBUTABLE PROPORTION. A measure of the public health impact of a causative factor; proportion of a disease in a group that is exposed to a particular factor which can be attributed to their exposure to that factor.

B

BAR CHART. A visual display of the size of the different categories of a variable. Each category or value of the variable is represented by a bar.

BIAS. Deviation of results or inferences from the truth, or processes leading to such systematic deviation. Any trend in the collection, analysis, interpretation, publication, or review of data that can lead to conclusions that are systematically different from the truth.

BIOLOGIC TRANSMISSION. The indirect vector-borne transmission of an infectious agent in which the agent undergoes biologic changes within the vector before being transmitted to a new host.

BOX PLOT. A visual display that summarizes data using a “box and whiskers” format to show the minimum and maximum values (ends of the whiskers), interquartile range (length of the box), and median (line through the box).

C

CARRIER. A person or animal without apparent disease who harbors a specific infectious agent and is capable of transmitting the agent to others. The carrier state may occur in an individual with an infection that is inapparent throughout its course (known as asymptomatic carrier), or during the incubation period, convalescence, and postconvalescence of an individual with a clinically recognizable disease. The carrier state may be of short or long duration (transient carrier or chronic carrier).

CASE. In epidemiology, a countable instance in the population or study group of a particular disease, health disorder, or condition under investigation. Sometimes, an individual with the particular disease.

CASE-CONTROL STUDY. A type of observational analytic study. Enrollment into the study is based on presence (“case”) or absence (“control”) of disease. Characteristics such as previous exposure are then compared between cases and controls.

CASE DEFINITION. A set of standard criteria for deciding whether a person has a particular disease or health-related condition, by specifying clinical criteria and limitations on time, place, and person.

CASE-FATALITY RATE. The proportion of persons with a particular condition (cases) who die from that condition. The denominator is the number of incident cases; the numerator is the number of cause-specific deaths among those cases.

CAUSE OF DISEASE. A factor (characteristic, behavior, event, etc.) that directly influences the occurrence of disease. A reduction of the factor in the population should lead to a reduction in the occurrence of disease.

CAUSE-SPECIFIC MORTALITY RATE. The mortality rate from a specified cause for a population. The numerator is the number of deaths attributed to a specific cause during a specified time interval; the denominator is the size of the population at the midpoint of the time interval.

CENSUS. The enumeration of an entire population, usually with details being recorded on residence, age, sex, occupation, ethnic group, marital status, birth history, and relationship to head of household.

CHAIN OF INFECTION. A process that begins when an agent leaves its reservoir or host through a portal of exit, and is conveyed by some mode of transmission, then enters through an appropriate portal of entry to infect a susceptible host.

CLASS INTERVAL. A span of values of a continuous variable which are grouped into a single category for a frequency distribution of that variable.

CLUSTER. An aggregation of cases of a disease or other health-related condition, particularly cancer and birth defects, which are closely grouped in time and place. The number of cases may or may not exceed the expected number; frequently the expected number is not known.

COHORT. A well-defined group of people who have had a common experience or exposure, who are then followed up for the incidence of new diseases or events, as in a cohort or prospective study. A group of people born during a particular period or year is called a birth cohort.

COHORT STUDY. A type of observational analytic study. Enrollment into the study is based on exposure characteristics or membership in a group. Disease, death, or other health-related outcomes are then ascertained and compared.

COMMON SOURCE OUTBREAK. An outbreak that results from a group of persons being exposed to a common noxious influence, such as an infectious agent or toxin. If the group is exposed over a relatively brief period of time, so that all cases occur within one incubation period, then the common source outbreak is further classified as a point source outbreak. In some common source outbreaks, persons may be exposed over a period of days, weeks, or longer, with the exposure being either intermittent or continuous.

CONFIDENCE INTERVAL. A range of values for a variable of interest, e.g., a rate, constructed so that this range has a specified probability of including the true value of the variable. The specified probability is called the confidence level, and the end points of the confidence interval are called the confidence limits.

CONFIDENCE LIMIT. The minimum or maximum value of a confidence interval.

CONTACT. Exposure to a source of an infection, or a person so exposed.

CONTAGIOUS. Capable of being transmitted from one person to another by contact or close proximity.

CONTINGENCY TABLE. A two-variable table with cross-tabulated data.

CONTROL. In a case-control study, comparison group of persons without disease.

CRUDE MORTALITY RATE. The mortality rate from all causes of death for a population.

CUMULATIVE FREQUENCY. In a frequency distribution, the number or proportion of cases or events with a particular value or in a particular class interval, plus the total number or proportion of cases or events with smaller values of the variable.

CUMULATIVE FREQUENCY CURVE. A plot of the cumulative frequency rather than the actual frequency for each class interval of a variable. This type of graph is useful for identifying medians, quartiles, and other percentiles.

D

DEATH-TO-CASE RATIO. The number of deaths attributed to a particular disease during a specified time period divided by the number of new cases of that disease identified during the same time period.

DEMOGRAPHIC INFORMATION. The “person’ characteristics--age, sex, race, and occupation--of descriptive epidemiology used to characterize the populations at risk.

DENOMINATOR. The lower portion of a fraction used to calculate a rate or ratio. In a rate, the denominator is usually the population (or population experience, as in person-years, etc.) at risk.

DEPENDENT VARIABLE. In a statistical analysis, the outcome variable(s) or the variable(s) whose values are a function of other variable(s) (called independent variable(s) in the relationship under study).

DESCRIPTIVE EPIDEMIOLOGY. The aspect of epidemiology concerned with organizing and summarizing health-related data according to time, place, and person.

DETERMINANT. Any factor, whether event, characteristic, or other definable entity, that brings about change in a health condition, or in other defined characteristics.

DIRECT TRANSMISSION. The immediate transfer of an agent from a reservoir to a susceptible host by direct contact or droplet spread.

DISTRIBUTION. In epidemiology, the frequency and pattern of health-related characteristics and events in a population. In statistics, the observed or theoretical frequency of values of a variable.

DOT PLOT. A visual display of the actual data points of a noncontinuous variable.

DROPLET NUCLEI. The residue of dried droplets that may remain suspended in the air for long periods, may be blown over great distances, and are easily inhaled into the lungs and exhaled.

DROPLET SPREAD. The direct transmission of an infectious agent from a reservoir to a susceptible host by spray with relatively large, short-ranged aerosols produced by sneezing, coughing, or talking.

E

ENDEMIC DISEASE. The constant presence of a disease or infectious agent within a given geographic area or population group; may also refer to the usual prevalence of a given disease within such area or group.

ENVIRONMENTAL FACTOR. An extrinsic factor (geology, climate, insects, sanitation, health services, etc.) which affects the agent and the opportunity for exposure.

EPIDEMIC. The occurrence of more cases of disease than expected in a given area or among a specific group of people over a particular period of time.

EPIDEMIC CURVE. A histogram that shows the course of a disease outbreak or epidemic by plotting the number of cases by time of onset.

EPIDEMIC PERIOD. A time period when the number of cases of disease reported is greater than expected.

EPIDEMIOLOGIC TRIAD. The traditional model of infectious disease causation. Includes three components: an external agent, a susceptible host, and an environment that brings the host and agent together, so that disease occurs.

EPIDEMIOLOGY. The study of the distribution and determinants of health-related states or events in specified populations, and the application of this study to the control of health problems.

EVALUATION. A process that attempts to determine as systematically and objectively as possible the relevance, effectiveness, and impact of activities in the light of their objectives.

EXPERIMENTAL STUDY. A study in which the investigator specifies the exposure category for each individual (clinical trial) or community (community trial), then follows the individuals or community to detect the effects of the exposure.

EXPOSED (GROUP). A group whose members have been exposed to a supposed cause of disease or health state of interest, or possess a characteristic that is a determinant of the health outcome of interest.

F

FREQUENCY DISTRIBUTION. A complete summary of the frequencies of the values or categories of a variable; often displayed in a two column table: the left column lists the individual values or categories, the right column indicates the number of observations in each category.

FREQUENCY POLYGON. A graph of a frequency distribution with values of the variable on the *x-axis* and the number of observations on the *y-axis*; data points are plotted at the midpoints of the intervals and are connected with a straight line.

G

GRAPH. A way to show quantitative data visually, using a system of coordinates.

H

HEALTH. A state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity.

HEALTH INDICATOR. A measure that reflects, or indicates, the state of health of persons in a defined population, e.g., the infant mortality rate.

HEALTH INFORMATION SYSTEM. A combination of health statistics from various sources, used to derive information about health status, health care, provision and use of services, and impact on health.

HIGH-RISK GROUP. A group in the community with an elevated risk of disease.

HISTOGRAM. A graphic representation of the frequency distribution of a continuous variable. Rectangles are drawn in such a way that their bases lie on a linear scale representing different intervals, and their heights are proportional to the frequencies of the values within each of the intervals.

HOST. A person or other living organism that can be infected by an infectious agent under natural conditions.

HOST FACTOR. An intrinsic factor (age, race, sex, behaviors, etc.) which influences an individual's exposure, susceptibility, or response to a causative agent.

HYPERENDEMIC DISEASE. A disease that is constantly present at a high incidence and/or prevalence rate.

HYPOTHESIS. A supposition, arrived at from observation or reflection, that leads to refutable predictions. Any conjecture cast in a form that will allow it to be tested and refuted.

HYPOTHESIS, NULL. The first step in testing for statistical significance in which it is assumed that the exposure is not related to disease.

HYPOTHESIS, ALTERNATIVE. The hypothesis, to be adopted if the null hypothesis proves implausible, in which exposure is associated with disease.

I

IMMUNITY, ACTIVE. Resistance developed in response to stimulus by an antigen (infecting agent or vaccine) and usually characterized by the presence of antibody produced by the host.

IMMUNITY, HERD. The resistance of a group to invasion and spread of an infectious agent, based on the resistance to infection of a high proportion of individual members of the group. The resistance is a product of the number susceptible and the probability that those who are susceptible will come into contact with an infected person.

IMMUNITY, PASSIVE. Immunity conferred by an antibody produced in another host and acquired naturally by an infant from its mother or artificially by administration of an antibody-containing preparation (antiserum or immune globulin).

INCIDENCE RATE. A measure of the frequency with which an event, such as a new case of illness, occurs in a population over a period of time. The denominator is the population at risk; the numerator is the number of new cases occurring during a given time period.

INCUBATION PERIOD. A period of subclinical or inapparent pathologic changes following exposure, ending with the onset of symptoms of infectious disease.

INDEPENDENT VARIABLE. An exposure, risk factor, or other characteristic being observed or measured that is hypothesized to influence an event or manifestation (the dependent variable).

INDIRECT TRANSMISSION. The transmission of an agent carried from a reservoir to a susceptible host by suspended air particles or by animate (vector) or inanimate (vehicle) intermediaries.

INDIVIDUAL DATA. Data that have not been put into a frequency distribution or rank ordered.

INFECTIVITY. The proportion of persons exposed to a causative agent who become infected by an infectious disease.

INFERENCE, STATISTICAL. In statistics, the development of generalizations from sample data, usually with calculated degrees of uncertainty.

INTERQUARTILE RANGE. The central portion of a distribution, calculated as the difference between the third quartile and the first quartile; this range includes about one-half of the observations in the set, leaving one-quarter of the observations on each side.

L

LATENCY PERIOD. A period of subclinical or inapparent pathologic changes following exposure, ending with the onset of symptoms of chronic disease.

M

MEAN, ARITHMETIC. The measure of central location commonly called the average. It is calculated by adding together all the individual values in a group of measurements and dividing by the number of values in the group.

MEAN, GEOMETRIC. The mean or average of a set of data measured on a logarithmic scale.

MEASURE OF ASSOCIATION. A quantified relationship between exposure and disease; includes relative risk, rate ratio, odds ratio.

MEASURE OF CENTRAL LOCATION. A central value that best represents a distribution of data. Measures of central location include the mean, median, and mode. Also called the measure of central tendency.

MEASURE OF DISPERSION. A measure of the spread of a distribution out from its central value. Measures of dispersion used in epidemiology include the interquartile range, variance, and the standard deviation.

MEDIAN. The measure of central location which divides a set of data into two equal parts.

MEDICAL SURVEILLANCE. The monitoring of potentially exposed individuals to detect early symptoms of disease.

MIDRANGE. The halfway point or midpoint in a set of observations. For most types of data, it is calculated as the sum of the smallest observation and the largest observation, divided by two. For age data, one is added to the numerator. The midrange is usually calculated as an intermediate step in determining other measures.

MODE. A measure of central location, the most frequently occurring value in a set of observations.

MORBIDITY. Any departure, subjective or objective, from a state of physiological or psychological well-being.

MORTALITY RATE. A measure of the frequency of occurrence of death in a defined population during a specified interval of time.

MORTALITY RATE, INFANT. A ratio expressing the number of deaths among children under one year of age reported during a given time period divided by the number of births reported during the same time period. The infant mortality rate is usually expressed per 1,000 live births.

MORTALITY RATE, NEONATAL. A ratio expressing the number of deaths among children from birth up to but not including 28 days of age divided by the number of live births reported during the same time period. The neonatal mortality rate is usually expressed per 1,000 live births.

MORTALITY RATE, POSTNEONATAL. A ratio expressing the number of deaths among children from 28 days up to but not including 1 year of age during a given time period divided by the number of lives births reported during the same time period. The postneonatal mortality rate is usually expressed per 1,000 live births.

N

NATURAL HISTORY OF DISEASE. The temporal course of disease from onset (inception) to resolution.

NECESSARY CAUSE. A causal factor whose presence is required for the occurrence of the effect (of disease).

NOMINAL SCALE. Classification into unordered qualitative categories; e.g., race, religion, and country of birth as measurements of individual attributes are purely nominal scales, as there is no inherent order to their categories.

NORMAL CURVE. A bell-shaped curve that results when a normal distribution is graphed.

NORMAL DISTRIBUTION. The symmetrical clustering of values around a central location. The properties of a normal distribution include the following: (1) It is a continuous, symmetrical distribution; both tails extend to infinity; (2) the arithmetic mean, mode, and median are identical; and, (3) its shape is completely determined by the mean and standard deviation.

NUMERATOR. The upper portion of a fraction.

O

OBSERVATIONAL STUDY. Epidemiological study in situations where nature is allowed to take its course. Changes or differences in one characteristic are studied in relation to changes or differences in others, without the intervention of the investigator.

ODDS RATIO. A measure of association which quantifies the relationship between an exposure and health outcome from a comparative study; also known as the cross-product ratio.

ORDINAL SCALE. Classification into ordered qualitative categories; e.g., social class (I, II, III, etc.), where the values have a distinct order, but their categories are qualitative in that there is no natural (numerical) distance between their positive values.

OUTBREAK. Synonymous with epidemic. Sometimes the preferred word, as it may escape sensationalism associated with the word epidemic. Alternatively, a localized as opposed to generalized epidemic.

P

PANDEMIC. An epidemic occurring over a very wide area (several countries or continents) and usually affecting a large proportion of the population.

PATHOGENICITY. The proportion of persons infected, after exposure to a causative agent, who then develop clinical disease.

PERCENTILE. The set of numbers from 0 to 100 that divide a distribution into 100 parts of equal area, or divide a set of ranked data into 100 class intervals with each interval containing 1/100 of the observations. A particular percentile, say the 5th percentile, is a cut point with 5 percent of the observations below it and the remaining 95% of the observations above it.

PERIOD PREVALENCE. The amount a particular disease present in a population over a period of time.

PERSON-TIME RATE. A measure of the incidence rate of an event, e.g., a disease or death, in a population at risk over an observed period to time, that directly incorporates time into the denominator.

PIE CHART. A circular chart in which the size of each “slice” is proportional to the frequency of each category of a variable.

POINT PREVALENCE. The amount of a particular disease present in a population at a single point in time.

POPULATION. The total number of inhabitants of a given area or country. In sampling, the population may refer to the units from which the sample is drawn, not necessarily the total population of people.

PREDICTIVE VALUE POSITIVE. A measure of the predictive value of a reported case or epidemic; the proportion of cases reported by a surveillance system or classified by a case definition which are true cases.

PREVALENCE. The number or proportion of cases or events or conditions in a given population.

PREVALENCE RATE. The proportion of persons in a population who have a particular disease or attribute at a specified point in time or over a specified period of time.

PROPAGATED OUTBREAK. An outbreak that does not have a common source, but instead spreads from person to person.

PROPORTION. A type of ratio in which the numerator is included in the denominator. The ratio of a part to the whole, expressed as a "decimal fraction" (e.g., 0.2), as a fraction (1/5), or, loosely, as a percentage (20%).

PROPORTIONATE MORTALITY. The proportion of deaths in a specified population over a period of time attributable to different causes. Each cause is expressed as a percentage of all deaths, and the sum of the causes must add to 100%. These proportions are not mortality rates, since the denominator is all deaths, not the population in which the deaths occurred.

PUBLIC HEALTH SURVEILLANCE. The systematic collection, analysis, interpretation, and dissemination of health data on an ongoing basis, to gain knowledge of the pattern of disease occurrence and potential in a community, in order to control and prevent disease in the community.

R

RACE-SPECIFIC MORTALITY RATE. A mortality rate limited to a specified racial group. Both numerator and denominator are limited to the specified group.

RANDOM SAMPLE. A sample derived by selecting individuals such that each individual has the same probability of selection.

RANGE. In statistics, the difference between the largest and smallest values in a distribution. In common use, the span of values from smallest to largest.

RATE. An expression of the frequency with which an event occurs in a defined population.

RATE RATIO. A comparison of two groups in terms of incidence rates, person-time rates, or mortality rates.

RATIO. The value obtained by dividing one quantity by another.

RELATIVE RISK. A comparison of the risk of some health-related event such as disease or death in two groups.

REPRESENTATIVE SAMPLE. A sample whose characteristics correspond to those of the original population or reference population.

RESERVOIR. The habitat in which an infectious agent normally lives, grows and multiplies; reservoirs include human reservoirs, animals reservoirs, and environmental reservoirs.

RISK. The probability that an event will occur, e.g. that an individual will become ill or die within a stated period of time or age.

RISK FACTOR. An aspect of personal behavior or lifestyle, an environmental exposure, or an inborn or inherited characteristic that is associated with an increased occurrence of disease or other health-related event or condition.

RISK RATIO. A comparison of the risk of some health-related event such as disease or death in two groups.

S

SAMPLE. A selected subset of a population. A sample may be random or non-random and it may be representative or non-representative.

SCATTER DIAGRAM. A graph in which each dot represents paired values for two continuous variables, with the *x-axis* representing one variable and the *y-axis* representing the other; used to display the relationship between the two variables; also called a scattergram.

SEASONALITY. Change in physiological status or in disease occurrence that conforms to a regular seasonal pattern.

SECONDARY ATTACK RATE. A measure of the frequency of new cases of a disease among the contacts of known cases.

SECULAR TREND. Changes over a long period of time, generally years or decades.

SENSITIVITY. The ability of a system to detect epidemics and other changes in disease occurrence. The proportion of persons with disease who are correctly identified by a screening test or case definition as having disease.

SENTINEL SURVEILLANCE. A surveillance system in which a pre-arranged sample of reporting sources agrees to report all cases of one or more notifiable conditions.

SEX-SPECIFIC MORTALITY RATE. A mortality rate among either males or females.

SKEWED. A distribution that is asymmetrical.

SPECIFICITY. The proportion of persons without disease who are correctly identified by a screening test or case definition as not having disease.

SPORADIC. A disease that occurs infrequently and irregularly.

SPOT MAP. A map that indicates the location of each case of a rare disease or outbreak by a place that is potentially relevant to the health event being investigated, such as where each case lived or worked.

STANDARD DEVIATION. The most widely used measure of dispersion of a frequency distribution, equal to the positive square root of the variance.

STANDARD ERROR (OF THE MEAN). The standard deviation of a theoretical distribution of sample means about the true population mean.

SUFFICIENT CAUSE. A causal factor or collection of factors whose presence is always followed by the occurrence of the effect (of disease).

SURVEILLANCE. see PUBLIC HEALTH SURVEILLANCE

SURVIVAL CURVE. A curve that starts at 100% of the study population and shows the percentage of the population still surviving at successive times for as long as information is available. May be applied not only to survival as such, but also to the persistence of freedom from a disease, or complication or some other endpoint.

T

TABLE. A set of data arranged in rows and columns.

TABLE SHELL. A table that is complete except for the data.

TRANSMISSION OF INFECTION. Any mode or mechanism by which an infectious agent is spread through the environment or to another person.

TREND. A long-term movement or change in frequency, usually upwards or downwards.

U

UNIVERSAL PRECAUTIONS. Recommendations issued by CDC to minimize the risk of transmission of bloodborne pathogens, particularly HIV and HBV, by health care and public safety workers. Barrier precautions are to be used to prevent exposure to blood and certain body fluids of all patients.

V

VALIDITY. The degree to which a measurement actually measures or detects what it is supposed to measure.

VARIABLE. Any characteristic or attribute that can be measured.

VARIANCE. A measure of the dispersion shown by a set of observations, defined by the sum of the squares of deviations from the mean, divided by the number of degrees of freedom in the set of observations.

VECTOR. An animate intermediary in the indirect transmission of an agent that carries the agent from a reservoir to a susceptible host.

VEHICLE. An inanimate intermediary in the indirect transmission of an agent that carries the agent from a reservoir to a susceptible host.

VIRULENCE. The proportion of persons with clinical disease, who after becoming infected, become severely ill or die.

VITAL STATISTICS. Systematically tabulated information about births, marriages, divorces, and deaths, based on registration of these vital events.

Y

YEARS OF POTENTIAL LIFE LOST. A measure of the impact of premature mortality on a population, calculated as the sum of the differences between some predetermined minimum or desired life span and the age of death for individuals who died earlier than that predetermined age.

Z

ZOONOSES. An infectious disease that is transmissible under normal conditions from animals to humans.

Appendix B
Formula Reference Sheet

Mean From individual data: $\bar{x} = \frac{\sum x_i}{n}$

Geometric Mean Geometric mean is the mean of a set of data measured on a logarithmic scale.

$$\bar{x}_{geo} = antilog\ (\frac{1}{n} \sum\ Log\ x_i)$$

Median Identifying the median from individual data:

1. Arrange the observations in increasing or decreasing order
2. Find the middle rank with the following formula:

   $$Middle\ rank = \frac{(n+1)}{2}$$

   a. If the number of observations (*n*) is odd, the middle rank falls on an observation.

   b. If *n* is even, the middle rank falls between two observations.

3. Identify the value of the median:

   a. If the middle rank falls on a specific observation (that is, if *n* is odd), the median is equal to the value of that observation.

   b. If the middle rank falls between two observations (that is, if *n* is even) the median is equal to the average (i.e., the arithmetic mean) of the values of those observations.

Identifying the median from a frequency distribution:

1. Identify the middle rank of the data as in step 2 above.
2. Starting with the first value (row), add the frequencies cumulatively. Stop when the cumulative frequency equals or exceeds the middle rank.
3. Identify the median as the **value** at the middle rank.

   a. If the middle rank falls within a particular value (row), the median equals that value.

   b. If the middle rank falls between two values (row), the median is calculated as the average (mean) of the two values that the middle rank lies between.

Mode 1. Arrange the data into a frequency distribution, showing the values of the variable (x_i) and the frequency (f_i) with which each value occurs.

2. Identify the value that occurs most often.

Σ = (Greek letter sigma) = sum of
n = the number of observations
x_i = i-th observation (x_1=1st observation, x_4 = 4th observation)
f_i = frequency of x_i
x_1 = lowest value in the set of observations
x_n = highest value in the set of observations

Midrange Formula for calculating the midrange from a set of observations:

$$\textit{Midrange (most types of data)} = \frac{(x_1 + x_n)}{2}$$

$$\textit{Midrange (age data)} = \frac{(x_1 + x_n + 1)}{2}$$

1. Rank the observations in order of increasing value.
2. Identify smallest and largest values.
3. Calculate midrange with appropriate formula.

Range
1. Arrange the data into a frequency distribution.
2. Identify the minimum and maximum values.
3. Calculate the range. Range = Maximum – Minimum

Interquartile range

1. Arrange the observations in increasing order.
2. Find the position of the 1st and 3rd quartiles.

   Position of 1st quartile (Q_1) = $\frac{(n+1)}{4}$

   Position of 3rd quartile (Q_3) = $\frac{3(n+1)}{4}$

3. Identify the value of the 1st and 3rd quartiles
   - If a quartile lies on an observation (i.e., if its position is a whole number), the value of the quartile is the value of that observation.
   - If a quartile lies between observations, the value of the quartile is the value of the lower observation plus the specified fraction of the difference between the observations.
4. Calculate the interquartile range as Q_3 minus Q_1.

Variance Variance from individual data = $s^2 = \frac{n\sum x_i^2 - (\sum x_i)^2}{n(n-1)}$

Standard Deviation Standard deviation = $s = \sqrt{s^2} = \sqrt{\frac{n\sum x_i^2 - (\sum x_i)^2}{n(n-1)}}$

Standard Error of Mean Standard error of the mean = SE = $\frac{s}{\sqrt{n}}$

Confidence Limits These formulas used with sample sizes of at least 30.

Lower 95% confidence limit = mean − (1.96 × SE)

Upper 95% confidence limit = mean + (1.96 × SE)

Σ = (Greek letter sigma) = sum of
n = the number of observations
x_i = i-th observation (x_1=1st observation, x_4 = 4th observation)
f_i = frequency of x_i
x_1 = lowest value in the set of observations
x_n = highest value in the set of observations

Appendix C
Case Definitions for Public Health Surveillance

Acquired Immunodeficiency Syndrome (AIDS)

Surveillance case definitions for acquired immunodeficiency syndrome (AIDS) and human immunodeficiency virus (HIV) infection have been previously published in:

CDC, Revision of the CDC surveillance case definition for acquired immunodeficiency syndrome. MMWR 1987;36(no. 1S).

Case classification systems have also been published in:

CDC. Classification system for human T-lymphotropic virus type III/lymphadenopathy-associated virus infections. MMWR 1986;35:334-9.CDC.
Classification system for human immunodeficiency virus (HIV) infection in children under 13 years of age. MMWR 1987;36:225-30,235.

Amebiasis

Clinical description

Infection of the large intestine by *Entamoeba histolytica* may result in an illness of variable severity, ranging from mild, chronic diarrhea to fulminant dysentery. Infection may also be asymptomatic.
Extraintestinal infection may also occur. The most common is hepatic abscess.

Laboratory criteria for diagnosis

Intestinal amebiasis

- Demonstration of cysts or trophozoites of *E. histolytica* in stool, or
- Demonsration of trophozoites in tissue biopsy or ulcer scrapings by culture or histopathology

Extraintestinal amebiasis

- Demonstration of *E. histolytica* trophozoites in extraintestinal tissue

Case classification

Confirmed,intestinal amebiasis: a clinically compatible illness that is laboratory confirmed

Confirmed, extraintestinal amebiasis: a parasitologically confirmed infection of exraintestinal tissue; or among symptomatic persons with clinical and/or radiographic findings consistent with extraintestinal infection, demonstration of specific antibody against *E. histolytica* as measured by indirect hemagglutination (IHA) or other reliable immunodiagnostic test such as enzyme-linked immunosorbent assay (EISA).

Comment

Asymptomatic intestinal carriage of *E. histolytica* should not be reported. Among asymptomatic persons, a positive serologic test does not necessarily indicate extraintestinal amebiasis.

Anthrax

Clinical description

Illness with acute onset characterized by several distinct clinical forms:

- Cutaneous (a skin lesion evolving over 2 to 6 days from a papule, through a vesicular stage, to a depressed black eschar)
- Inhalation (a brief prodrome resembling a viral respiratory illness followed by development of hypoxia and dyspnea, with x-ray evidence of mediastinal widening)
- Intestinal (severe abdominal distress followed by fever and signs of septicemia)
- Oropharyngeal (mucosal lesion in the oral cavity or oropharynx, cervical adenopathy and edema, and fever)

Laboratory criteria for diagnosis

- Isolation of *Bacillus anthracis* from a clinical specimen, or
- Fourfold or greater rise in either the anthrax enzyme-linked immunosorbent assay (ELISA) or elecrophoretic immunotransblot (EIBT) titer between acute- and convalescent-phase serum specimens obtained greater than or equal to 2 weeks apart, or
- Anthrax ELISA titer greater than or equal to 64 or an EITB reaction to the protective antigen and/or lethal factor bands in one or more serum samples obtained after onset of symptoms, or
- Demonstration of *B. anthracis* in a clinical specimen by immunofluorescence

Case classification

Confirmed: a clinically compatible illness that is laboratory confirmed

Aseptic Meningitis

Clinical description

A syndrome characterized by acute onset of meningeal symptoms, fever, and cerebrospinal fluid pleocytosis, with bacteriologically sterile cultures. (See **Encephalitis, Arboviral.**)

Laboratory criteria for diagnosis

- No evidence of bacterial or fungal meningitis

Case classification

Confirmed: a clinically compatible illness diagnosed by a physician as aseptic meningitis, with no laboratory evidence of bacterial or fungal meningitis

Comment

Aseptic meningitis is a syndrome of multiple etiologies, but many cases are caused by a viral agent.

Botulism, Foodborne

Clinical description

Ingestion of botulinal toxin results in an illness of variable severity. Common symptoms are diplopia, blurred vision, and bulbar weakness. Symmetric paralysis may progress rapidly. (See *CDC Botulism Manual.*)

Laboratory criteria for diagnosis

- Detection of botulinal toxin in serum, stool, or patient's food, or
- Isolation of *Clostridium botulinum* from stool

Case classification

Confirmed: a clinically compatible illness that is laboratory confirmed or that occurs among persons who ate the same food as persons with laboratory-confirmed botulism

Comment

Botulism may be diagnosed without laboratory confirmation if the clinical and epidemiologic evidence is overwhelming.

Botulism, Infant

Clinical description

An illness of infants, characterized by constipation, poor feeding, and "failure to thrive" that may be followed by progressive weakness, impaired respiration, and death. (See *CDC Botulism Manual*.)

Laboratory criteria for diagnosis

- Detection of botulinal toxin in stool, or
- Isolation of *Clostridium botulinum* from stool

Case classification

Confirmed: a clinically compatible, laboratory-confirmed illness occurring among children less than 1 year of age

Botulism, Wound

Clinical description

An illness resulting from toxin produced by *Clostridium botulinum* that has infected a wound. (See *CDC Botulism Manual.)*

Laboratory criteria for diagnosis

- Detection of botulinal toxin in serum, or
- Isolation of *Clostridium botulinum* from wound

Case classification

Confirmed: a clinically compatible illness that is laboratory confirmed among patients with no suspect food exposure and with a history of a fresh, contaminated wound in the 2 weeks before onset of symptoms

Botulism, Other

Clinical description

See **Botulism, Foodborne.**

Laboratory criteria for diagnosis

- Detection of botulinal toxin in clinical specimen, or
- Isolation of *Clostridium botulinum* from clinical specimen

Case classification

Confirmed: an illness clinically compatible with botulism that is laboratory confirmed among patients greater than 11 months of age, without histories of ingestion of suspect food, and without wounds

Brucellosis

Clinical description

An illness characterized by acute or insidious onset of fever, night sweats, undue fatigue, anorexia, weight loss, headache and arthralgia

Laboratory criteria for diagnosis

- Isolation of *Brucella* sp. from a clinical specimen, or
- Fourfold or greater rise in *Brucella* agglutination titer between acute- and convalescent-phase serum specimens obtained greater than or equal to 2 weeks apart and studied at the same laboratory, or
- Demonstration of *Brucella* sp. in a clinical specimen by immunofluorescence

Case classification

Probable: a clinically compatible case that is epidemiologically linked to a confirmed case or that has supportive serology (i.e., *Brucella* agglutination titer of greater than or equal to 160 in one or more serum specimens obtained after onset of symptoms)

Confirmed: a clinically compatible illness that is laboratory confirmed

Campylobacter Infection

Clinical description

Infection that may result in diarrheal illness of variable severity

Laboratory criteria for diagnosis

- Isolation of *Campylobacter* from any clinical specimen

Case classification

Probable: a clinically compatible illness that is epidemiologically linked to a confirmed case

Confirmed: a case that is laboratory confirmed

Comment

Only confirmed cases are reported to the laboratory-based surveillance system operated by the Enteric Diseases Branch, Center for Infectious Diseases, CDC. States collecting data on *Camppylobacter* infection may wish to collect reports of both probable and confirmed cases, but the data are not currently published in the MMWR.

Chancroid

Clinical description

A sexually transmitted disease characterized by painful genital ulceration and inflammatory inguinal adenopathy. The disease is cased by infection with *Haemophilus ducreyi.*

Laboratory criteria for diagnosis

- Isolation of *H. ducreyi* from a clinical specimen

Case classification

Probable: a clinically compatible case with one or more painful genital ulcers and both a) no evidence of *Treponema pallidum* infection by darkfield examination of ulcer exudates or by a serologic test for syphilis performed at least 7 days after onset of ulcers, and b) the clinical presentation of the ulcer(s) is not typical of disease caused by herpes simplex virus (HSV), or HSV culture is negative

Confirmed: a case that is laboratory confirmed

Chlamydia trachomatis Infection

Clinical description

Infection with *Chlamydia trachomatis* may result in urethritis, epididymitis, cervicitis, acute salpingitis, or other syndromes when sexually transmitted. Perinatal infections may result in inclusion conjunctivitis and pneumonia among newborns. Other syndromes caused by C. trachomatis include lymphogranuloma venereum (see **Lymphogranuloma Venereum Infection**) and trachoma.

Laboratory criteria for diagnosis

- Isolation of *C. trachomatis* by culture, or
- Demonstration of *C. trachomatis* in a clinical specimen by antigen detection methods

Case classification

Confirmed: a case that is laboratory confirmed

Cholera

Clinical description

An illness characterized by diarrhea and/or vomiting. Severity is variable.

Laboratory criteria for diagnosis

- Isolation of toxigenic (cholera toxin-producing) *Vibrio cholerae* 01 from stool or vomitus, or
- Significant rise in vibriocidal antibodies in acute- and early convalescent-phase sera, or
- Significant fall in vibriocidal antibodies in early and late convalescent-phase sera among persons not recently vaccinated

Case classification

Confirmed: a clinically compatible illness that is laboratory confirmed

Comment

When other cases are known to be occurring, a less than fourfold rise in titer between acute- and convalescent-phase serum may be considered significant. Likewise, a less than fourfold fall between early and late convalescent-phase sera may be important in these circumstances. Only confirmed cases should be reported to the NNDSS. Illnesses due to strains of *V. cholerae* other than toxigenic *V. cholerae* should not be reported as cases of cholera.

Dengue Fever

Clinical description

An acute febrile illness characterized by frontal headache, retro-ocular pain, muscle and joint pain, and rash. The disease is transmitted by the *Aedes aegypti* mosquito and is confined to the tropics. Severe manifestations (dengue hemorrhagic fever and dengue shock syndrome) are rare, but may be fatal.

Laboratory criteria for diagnosis

- Isolation of dengue virus from serum and/or autopsy tissue samples, or
- Demonstration of a fourfold or greater rise or fall in reciprocal IgG or IgM antibody titers in paired serum samples to one or more dengue virus antigens, or
- Demonstration of dengue virus antigens in autopsy tissue samples by immunofluorescence or by hybridization probe

Case classification

Probable: a clinically compatible illness with supportive serology (a reciprocal IgG antibody titer of greater than or equal to 1280 or a positive IgM antibody test on a single convalescent-phase serum specimen to one or more dengue virus antigens)

Confirmed: a case that is laboratory confirmed

Comment

Dengue hemorrhagic fever is defined as acute onset of fever with nonspecific symptoms. This is followed by hemorrhagic manifestations that may include a positive tourniquet test[1] and/or minor or major bleeding phenomena, thrombocytopenia (less than or equal to 100,000/mm3), and hemoconcentration (hematocrit increased by greater than or equal to 20%), or other objective evidence of increasing capillary permeability; or decreasing hematocrit after severe frank hemorrhage, such as gastrointestinal bleeding. The definition for dengue shock syndrome follows all of the above criteria for dengue hemorrhagic fever and also includes hypotension or narrow pulse pressure (less than 20 Mm Hg).

Diphtheria

Clinical case definition

An upper respiratory tract illness characterized by sore throat, low-grade fever, and an adherent membrane of the tonsil(s), pharynx, and/or nose without other apparent cause (as reported by a health professional)

Laboratory criteria for diagnosis

- Isolation of *Corynebacterium diphtheriae* from a clinical specimen

Case classification

Probable: meets the clinical case definition, is not laboratory confirmed, and is not epidemiologically linked to a laboratory-confirmed case

Confirmed: meets the clinical case definition and is either laboratory confirmed or epidemiologically linked to a laboratory-confirmed case

Comment

Cutaneous diphtheria should not be reported

Encephalitis, Arboviral

Clinical description

Arboviral infection may result in a febrile illness of variable severity associated with neurologic symptoms ranging from headache to aseptic meningitis or encephalitis. Arborival encephalitis cannot be distinguished clinically from infection with other neurotropic viruses. Symptoms may include headache, confusion or other alterations in sensorium, nausea, or vomiting. Signs may include evidence of elevated intracranial pressure or meningeal irritation, cranial nerve palsies, paresis or paralysis, altered reflexes, or convulsions. (See **Aseptic Meningitis and Encephalitis, Primary.)**

Laboratory criteria for diagnosis

- Fourfold or greater rise in serum antibody titer, or
- Isolation of virus from or demonstration of viral antigen in tissue, blood, cerebrospinal fluid (CSF), or other body fluid, or
- Specific IgM antibody in CSF

Case classification

Probable: a clinically compatible illness occurring during a period when arbovirus transmission is likely to occur, and with the following supportive serology: a stable (twofold or greater change) elevated antibody titer to an arbovirus, e.g., greater than or equal to 320 by hemagglutination inhibition, greater than or equal to 128 by complement fixation, greater than orequal to 256 by immunofluorescence, greater than or equal to 160 by neutralization, or a positive serologic result byenzyme immunoassay (EIA)

Confirmed: a clinically compatible illness that is laboratory confirmed

Comment

The time of year in which arboviral transmission is likely to occur depends on the geographic location of exposure, the specific cycle of virus transmission, and local climatic conditions.

Arboviruses causing encephalitis include the following:

- St. Louis encephalitis
- Western equine encephalitis
- Eastern equine encephalitis
- California encephalitis (includes infections from the following viruses: LaCrosse, Jamestown Canyon, Snowshoe Hare, Trivittatus, and California viruses)
- Powassan encephalitis
- Other central nervous system infections transmitted by mosquitos, ticks, or midges (Venezuelan equine encephalitis, Cache Valley encephalitis)

Encephalitis, Postinfectious (or Parainfectious)

Clinical description

Encephalitis or meningoencephalitis that follows or occurs in combination with other viral illnesses that are not central nervous system illnesses, or after vaccine is administered. Symptoms may be due to hypersensitivity reaction. Primary encephalitis is excluded.

Case classification

Confirmed: a clinically compatible illness diagnosed by a physician as postinfectious (or parainfectious) encephalitis

Comment

Laboratory studies are important in clinical diagnosis but are not required for reporting purposes.

Encephalitis, Primary

Clinical description

An illness in which encephalitis is the major manifestation. Symptoms are due to direct invasion and replication of the infectious agent in the central nervous system, resulting in objective clinical evidence of cerebral or cerebellar dysfunction. Postinfectious (or parainfectious) encephalitis is excluded.

Case classification

Confirmed: a clinically compatible illness diagnosed by a physician as primary encephalitis

Comment

Laboratory studies are important in clinical diagnosis but are not required for reporting purposes. Primary encephalitis is a category used for reporting to the NNDSS. This category includes arboviral encephalitis and primary encephalitis of unspecified cause.

Foodborne Disease Outbreak

Clinical description

Symptoms of illness depend upon etiologic agent. (See *Guidelines for Confirmation of Foodborne and Waterborne Disease Outbreaks,* in press.)

Laboratory criteria for diagnosis

Depends upon etiologic agent. (See *Guidelines for Confirmation of Foodborne and Waterborne Disease Outbreaks,* in press.)

Definition

An incident in which two or more persons experience a similar illness after ingestion of a common food, and epidemiologic analysis implicates the food as the source of the illness.

Comment

There are two exceptions: one case of botulism or chemical poisoning constitutes an outbreak.

Genital Herpes (Herpes Simplex Virus)

Clinical description

An illness characterized by visible, painful genital or anogenital lesions

Laboratory criteria for diagnosis

- Isolation of herpes simplex virus from cervix, urethra, or anogenital lesion, or
- Demonstration of virus by antigen detection technique in clinical specimens from cervix, urethra, or anogenital lesion, or
- Demonstration of multinucleated giant cells on a Tzanck smear of scrapings from an anogenital lesion

Case classification

Probable: a clinically compatible case (in which primary and secondary syphilis have been ruled out by serology and darkfield microscopy, when available) with either a diagnosis of genital herpes based on clinical presentation (without laboratory confirmation) or a history of one or more previous episodes of similar genital lesions

Confirmed: a clinically compatible case that is laboratory confirmed

Comment

Herpes should be reported only one per patient. The first diagnosis for a patient with no previous diagnosis should be reported.

Genital Warts

Clinical description

An infection characterized by the presence of visible, exophytic (raised) growths on the internal or external genitalia, perineum, or perianal region

Laboratory criteria for diagnosis

- Histopathologic changes characteristic of human papillomavirus (HPV) infection on biopsy or exfoliative cytology

Case classification

Probable: a clinically compatible case without histopathologic diagnosis and without mircoscropic or serologic evidence that the growth is due to secondary syphilis.

Confirmed: a clinically compatible case that is laboratory confirmed

Giardiasis

Clinical description

An illness caused by the protozoan *Giardia lamblia* and characterized by diarrhea, abdominal cramps, bloating, weight loss, or malabsorption. Infected persons may be asymptomatic.

Laboratory criteria for diagnosis

- Demonstration of *G. lamblia* cysts in stool, or
- Demonstration of *G. lamblia* trophozoites in stool, duodenal fluid, or small bowel biopsy, or
- Demonstration of *G. lamblia* antigen in stool by a specific immunodiagnostic test such as enzyme-linked immunosorbent assay (ELISA)

Case classification

Confirmed, symptomatic: a laboratory-confirmed case associated with one or more of the symptoms described above

Confirmed, asymptomatic: a laboratory-confirmed case associated with none of the above symptoms

Gonorrhea

Clinical description

A sexually transmitted infection commonly manifested by urethritis, cervicitis, or salpingitis. Infection may be asymptomatic.

Laboratory criteria for diagnosis

- Isolation of *Neisseria gonorrhoeae* from a clinical specimen, or
- Observation of gram-negative intracellular diplococci in a urethral smear obtained from a man

Case classification

Probable: demonstration of gram-negative intracellular diplococci in an endocervical smear obtained from a woman, or a written (morbidity) report of gonorrhea submitted by a physician

Confirmed: a case that is laboratory confirmed

Granuloma Inguinale

Clinical description

A slowly progressive ulcerative disease of the skin and lymphatics of the genital and perianal area caused by infection with *Calymmatobacterium granulomatis.* A clinically compatible case would have one or more painless or minimally painful granulomatous lesions in the anogenital area.

Laboratory criteria for diagnosis

- Demonstration of intracytoplasmic Donovan bodies in Wright or Giemsa-stained smears or biopsies of granulation tissue

Case classification

Confirmed: a clinically compatible case that is laboratory confirmed

Haemophilus influenzae (Invasive Disease)

Clinical description

Invasive disease due to *Haemophillus influenzae* may produce any of several syndromes, including meningitis, bacteremia, epiglottitis, or pneumonia

Laboratory criteria for diagnosis

- Isolation of *H. influenzae* from a normally sterile site

Case classification

Probable: a clinically compatible illness with detection of *H. influenzae* type b antigen in cerebrospinal fluid

Confirmed: a clinically compatible illness that is culture confirmed

Comment

Antigen test results in urine or serum are unreliable for diagnosis of *H. influenzae* disease.

Hansen Disease

Clinical description

A chronic bacterial disease characterized by the involvement of mainly skin, peripheral nerves, and the mucosa of the upper airway. Clinical forms of Hansen disease represent a spectrum reflecting the cellular immune response to *Mycobacterium leprae*. Typical of the major forms of the disease are the following characteristics:

- Tuberculoid—one or a few well-demarcated, hypopigmented, and anesthetic skin lesions, frequently with active, spreading edges and a clearing center; peripheral nerve swelling or thickening may also occur
- Lepromatous—a number of erythematous papules and nodules or an infiltration of the face, hands, and feet with lesions in a bilaterial and symmetrical distribution that progress to thickening of the skin
- Borderline (dimorphous)—skin lesions characteristic of both the tuberculoid and lepromatous forms
- Indeterminate—early lesions, usually hypopigmented macules, without developed tuberculoid or lepromatous features

Laboratory criteria for diagnosis

- Demonstration of acid-fast bacilli in skin or dermal nerve, obtained from the full-thickness skin biopsy of a lepromatous lesion

Case classification

Confirmed: a clinically compatible case that is laboratory confirmed.

Hepatitis, Viral

Clinical case definition

An illness with a) discrete onset of symptoms and b) jaundice or elevated serum aminotransferase levels

Laboratory criteria for diagnosis

- Hepatitis A: IgM anti-HAV-positive
- Hepatitis B: IfM anti-HBc-positive (if done) or HbsAg-positive, and IgM anti-HAV-negative (if done)

- Non-A, Non-B Hepatitis: 1. IgM anti-HAV-negative, and 2. IgM anti-HBc-negative (if done) or HbsAg-negative, and 3. Serum aminotransferase levels greater than 2 ½ times the upper limit of normal
- Delta Hepatitis: HbsAg- or IgM anti-HBc-positive and anti-HDV-positive

Case classification

Confirmed: a case that meets the clinical case definition and is laboratory confirmed

Comment

A serologic test for IgG antibody to the recently described hepatitis C virus is available, and many cases of non-A, non-B hepatitis may be demonstrated to be due to infection with the hepatitis C virus. With this assay, however, a prolonged interval between onset of disease and detection of antibody may occur. Until a more specific test for acute hepatitis C becomes available, these cases should be reported as non-A, non-B hepatitis. Chronic carriage or chronic hepatitis should not be reported.

Kawasaki Syndrome

Clinical case definition

A febrile illness of greater than or equal to 5 days' duration, with at least four of the five following physical findings and no other more reasonable explanation for the observed clinical findings:

- Bilateral conjunctival injection
- Oral changes (erythema of lips or oropharynx, strawberry tongue, or fissuring of the lips)
- Peripheral extremity changes (edema, erythema, or generalized or periungual desquamation)
- Rash
- Cervical lymphadenopathy (at least one lymph node greater than or equal to 1.5 cm in diameter

Laboratory criteria for diagnosis

None

Case classification

Confirmed: a case that meets the clinical case definition

Comment

If fever disappears after intravenous gamma globulin therapy is started, fever may be of less than 5 days' duration, and the clinical case definition may still be met.

Legionellosis (Legionnaire's Disease)

Clinical description

An illness with acute onset, commonly characterized by fever, cough, and pneumonia that is confirmed by chest radiograph. Encephalopathy and diarrhea may also be included.

Laboratory criteria for diagnosis

- Isolation of Legionella from lung tissue, respiratory secretions, pleural fluid, blood, or other normally sterile sites, or
- Demonstration of a fourfold or greater rise in the reciprocal immunofluorescence (IF) antibody titer to greater than or equal to 128 against *Legionella pneumophila* serogroup 1, or
- Demonstration of *L. pneumophila* serogroup 1 in lung tissue, respiratory secretions, or pleural fluid by direct fluorescence antibody testing, or
- Demonstration of *L. pneumophila* serogroup 1 antigens in urine by radioimmunoassay

Case classification

Probable: a clinically compatible illness with demonstration of a reciprocal antibody titer greater than or equal to 256 from a single convalescent-phase serum specimen

Confirmed: a case that is laboratory confirmed

Leptospirosis

Clinical description

An illness characterized by fever, headache, chills, myalgia, conjunctival suffusion, and less frequently by meningitis, rash, jaundice, or renal insufficiency. Symptoms may be biphasic.

Laboratory criteria for diagnosis

- Isolation of *Leptospira* from a clinical specimen, or
- Fourfold or greater increase in *Leptospira* agglutination titer between acute- and convalescent-phase serum specimens obtained greater than or equal to 2 weeks apart and studied at the same laboratory, or
- Demonstration of *Leptospira* in a clinical specimen by immunofluorescence

Case classification

Probable: A clinically compatible case with supportive serology (i.e., a *Leptospira* agglutination titer of greater than or equal to 200 in one or more serum specimens)

Confirmed: a clinically compatible case that is laboratory confirmed

Listeriosis

Clinical description

Infection caused by *Listeria monocytogenes*, which may produce any of several clinical syndromes, including stillbirths, listeriosis of the newborn, meningitis, bacteremia, or localized infections

Laboratory criteria for diagnosis

- Isolation of *L. monocytogenes* from a normally sterile site

Case classification

Confirmed: a clinically compatible case that is laboratory confirmed

Lyme Disease

Clinical description

A systemic, tick-borne disease with protean manifestations, including dermatologic, rheumatologic, neurologic, and cardiac abnormalities. The best clinical marker for the disease is the initial skin lesion, erythema migrans, that occurs among 60%-80% of patients.

Clinical case definition

- Erythema migrans, or
- At least one late manifestation, as defined below, and laboratory confirmation of infection

Laboratory criteria for diagnosis

- Isolation of *Borrelia burgdoferi* from clinical specimen, or
- Demonstration of diagnostic levels of IgM and IgG antibodies to the spirochete in serum or CSP, or
- Significant change in IgM or IgG antibody response to *B. burgdorferi* in paired acute- and convalescent-phase serum samples

Case classification

Confirmed: a case that meets one of the clinical case definitions above

Comment

This surveillance case definition was developed for national reporting of Lyme disease; it is NOT appropriate for clinical diagnosis

Definition of terms used in the clinical description and case definition:

A. Erythema migrans (EM)

For purposes of surveillance, EM is defined as a skin lesion that typically begins as a red macule or papule and expands over a period of days to weeks to form a large round lesion, often with partial central clearing. A solitary lesion must reach at least 5 cm in size. Secondary lesions may also occur. Annular erythematous lesions occurring within several hours of a tick bite represent hypersensitivity reactions and do not quality as EM. For most patients, the expanding EM lesion is accompanied by other acute symptoms, particularly fatigue, fever, headache, mild stiff neck, arthralgia, or myalgia. These symptoms are typically intermittent. The diagnosis of EM must be made by a physician. Laboratory confirmation is recommended for persons with no known exposure.

B. Late manifestations

Late manifestations include any of the following **when an alternate explanation is not found:**

- Musculoskeletal system

  Recurrent, brief attacks (weeks or months0 of objective joint swelling in one or a few joints, **sometimes** followed by chronic arthritis in one or a few joints. Manifestations not considered as criteria for diagnosis include chronic progressive arthritis not preceded by brief attacks and chronic symmetrical polyarthritis. Additionally, arthralgia, mylgia, or fibromyalgia syndromes alone are not criteria for musculoskeletal involvement.

- Nervous system

  Any of the following, alone or in combination:

  Lymphocytic meningitis; cranial neuritis, particularly facial palsy (may be bilateral); radiculoneuropathy; or, rarely, encephalomyelitis. Encephalomyelitis must be confirmed by showing antibody production against *burgdorferi* in the cerebrospinal fluid (CSF), demonstrated by a higher titer of antibody in CSF than in serum. Headache, fatigue, paresthesia, or mild stiff neck alone are not criteria for neurologic involvement.

- Cardiovascular system

  Acute onset, high-grade (2£SD or 3£SD) atrioventricular conduction defects that resolve in days to weeks and are sometimes associated with myocarditis. Palpitations, bradycardia, bundle branch block, or myocarditis alone are not criteria for cardiovascular involvement.

C. Exposure

Exposure is defined as having been in wooded, brushy, or grassy areas (potential tick habitats) in a county in which Lyme disease is endemic no more than 30 days before onset of EM. A history of tick bit is NOT required.

D. Disease endemic to county

A county in which Lyme disease is endemic is one in which at least two definite cases have been previously acquired or in which a known tick vector has been shown to be infected with *B. burgdorferi*

E. Laboratory confirmation

As noted above, laboratory confirmation of infection with *B. burgdorferi* is established when a laboratory isolates the spirochete from tissue or body fluid, detects diagnostic levels of IgM or IgG antibodies to the spirochete in serum or CSF, or detects a significant change in antibody levels in paired acute- and convalescent-phase serum samples. States may determine the criteria for laboratory confirmation and diagnostic levels of antibody. Syphilis and other known causes of biologic false-positive serologic test results should be excluded when laboratory confirmation has been based on serologic testing alone.

Lymphogranuloma Venereum Infection

Clinical description

Infection with L((1)), L((2)), or L((3)) serovars of *Chlamydia trachomatis* may result in a disease characterized by genital lesions, suppurative regional lymphadenopathy, or hemorrhagic proctitis. The infection is usually sexually transmitted.

Laboratory criteria for diagnosis

- Isolation of *C. trachomatis*, serotype L((1)), L((2)), or L((3)), from clinical specimen, or
- Demonstration of inclusion bodies by immunofluorescence in leukocytes of an inguinal lymph node (bubo) aspirate, or
- Positive microimmunofluorescent serologic test for a lymphogranuloma venereum strain of *C. trachomatis* (in a clinically compatible case)

Case classification

Probable: a clinically compatible case with one or more tender fluctuant inquinal lymph nodes or characteristic proctogenital lesions with supportive laboratory findings of a single *C. trachomatis* complement fixation (CF) titer of greater than 64

Confirmed: a case that is laboratory confirmed

Malaria

Clinical description

Signs and symptoms are variable, but chills followed by fever and sweating constitute the classic malaria paroxysm. The diagnosis should be considered for any person who has been exposed to infection. Complications such as cerebral malaria may occur in *Plasmodium falciparum* infection. Asymptomatic parasitemia may occur among immune persons.

Laboratory criteria for diagnosis

- Demonstration of malaria parasites in blood films

Case classification

Confirmed: a person's first attack of laboratory-confirmed malaria that occurs in the United States, regardless of whether the person has experienced previous attacks of malaria while outside the country

Comment

A subsequent attack experienced by the same person but caused by a different *Plasmodium* species is counted as an additional case. A repeated attack experienced by the same person and caused by the same species in the United States is not considered an additional case. Blood smears from doubtful cases should be referred to the National Malaria Repository, CDC, for confirmation of the diagnosis.

In addition, cases are classified according to the following World Health Organization categories:

Autochthonous:

Indigenous—malaria acquired by mosquito transmission in an area where malaria is a regular occurrence

Introduced—malaria acquired by mosquito transmission from an imported case in an area where malaria is not a regular occurrence

Imported: malaria acquired outside a specific area (the United States and its territories)

Induced: malaria acquired through artificial means (e.g., blood transfusion, common syringes, or malariotherapy)

Relapsing: renewed manifestation (of clinical symptoms and/or parasitemia) of malarial infection that is separated from previous manifestations of the same infection by an interval greater than any interval due to the normal periodicity of the paroxysms

Cryptic: an isolated case of malaria not associated with secondary cases, as determined by appropriate epidemiologic investigations

Measles

Clinical case definition

An illness characterized by all of the following clinical features:

- a generalized rash lasting greater than or equal to 3 days
- a temperature greater than or equal to 38.3C (101F)
- a cough, coryza, or conjunctivitis

Laboratory criteria for diagnosis

- Isolation of measles virus from a clinical specimen, or
- Significant rise in measles antibody level by any standard serologic assay, or
- Positive serologic test for measles IgM antibody

Case classification

Suspect: any rash illness with fever

Probable: meets the clinical case definition, has no or noncontributory serologic or virologic testing, and is not epidemiologically linked to a probable or confirmed case

Confirmed: a case that is laboratory confirmed or that meets the clinical case definition and is epidemiologically linked to a confirmed or probable case. A laboratory-confirmed case does not need to meet the clinical case definition.

Comment

Two probable cases that are epidemiologically linked would be considered confirmed, even in the absence of laboratory confirmation. Only confirmed cases should be reported to the NNDSS.

Meningococcal Disease

Clinical description

Meningococcal disease presents most commonly as meningitis and/or meningococcemia that may progress rapidly to purpura fulminans, shock, and death. However, other manifestations may be observed.

Laboratory criteria for diagnosis

- Isolation of *Neisseria meningitides* from a normally sterile site

Case classification

Probable: a positive antigen test in cerebrospinal fluid or clinical purpura fulminans in the absence of a positive blood culture

Confirmed: a clinically compatible case that is culture confirmed

Comment

Antigen test results in urine or serum are unreliable for diagnosing meningococcal disease.

Mucopurulent Cervicitis

Clinical description

Cervical inflammation that is not the result of infection with *Neisseria gonorrhoeae* or *Trichomonas vaginalis*. Cervical inflammation is defined by the presence of one of the following criteria:

- Mucopurulent secretion (from the endocervix) that is yellow or green when viewed on a white, cotton-tipped swab (positive swab test)
- Induced endocervical bleeding (bleeding when the first swab is placed in the endocervix)

Laboratory criteria for diagnosis

- No evidence of *N. gonorrhoeae* infection by culture or Gram stain and no evidence of *T. vaginalis* on wet mount

Case classification

Confirmed: a clinically compatible case among females for whom gonorrhea and trichomonas infection are not found

Comment

Mucopurulent cervicitis (MPC) is a clinical diagnosis of exclusion. The syndrome may result from infection with several agents (see ***Chlamydia trachomatis* Infection**). If gonorrhea, trichomoniasis, and chlamydia are excluded, a clinically compatible case should be classified as MPC. An illness among women that meets the case definition of MPC and *Chlamydia trachomatis* infection should be classified as chlamydia.

Mumps

Clinical case definition

An illness with acute onset of unilateral or bilateral tender, self-limited swelling of the parotid or other salivary gland, lasting greater than or equal to 2 days, and without other apparent cause (as reported by a health professional)

Laboratory criteria for diagnosis

- Isolation of mumps virus from clinical specimen, or
- Significant rise in mumps antibody level by any standard serologic assay, or
- Positive serologic test for mumps IgM antibody

Case classification

Probable: meets the clinical case definition, has no or noncontributory serologic or virologic testing, and is not epidemiologically linked to a confirmed or probable case

Confirmed: a case that is laboratory confirmed or that meets the clinical case definition and is epidemiologically linked to a confirmed or probable case. A laboratory-confirmed case does not need to meet the clinical case definition.

Comment

Two probable cases that are epidemiologically linked would be considered confirmed, even in the absence of laboratory confirmation.

Nongonococcal Urethritis

Clinical description

Urethral inflammation that is not the result of infection with *Neisseria onorrhoeae.*

Urethral inflammation may be diagnosed by the presence of one of the following criteria:

- A visible abnormal urethral discharge (excludes scant amounts of clear mucus)
- A positive leukocyte esterase test from men less than 60 years of age without a history of kidney disease or bladder infection, prostate enlargement, urogenital anatomic anomaly, or recent urinary tract instrumentation
- Microscopic evidence of urethritis (greater than or equal to 5 WBC per high-power field) on a Gram stain of a urethral smear

Laboratory criteria for diagnosis

- No evidence of *N. gonorrhoeae* infection by culture or Gram stain

Case classification

Confirmed: a clinically compatible case among males in whom gonorrhea is not found, either by culture or Gram stain

Comment

Nongonococcal urethritis (NGU) is a clinical diagnosis of exclusion. The syndrome may result from infection with several agents (see ***Chlamydia trachomatis* Infection)**. A clinically compatible case excluding gonorrhea and chlamydia should be classified as NGU. An illness among men that meets the case definition of NGU and *C. trachomatis* infection should be classified as chlamydia.

Pelvic Inflammatory Disease

(NOTE: *The following definition is being reviewed by CSTE and CDC, and changes are anticipated.)*

Clinical case definition

A clinical syndrome resulting from the ascending spread of microorganisms from the vagina and endocervix to the endometrium, fallopian tubes and/or contiguous structures.

All of the following clinical criteria must be present:

- Abdominal direct tenderness
- Tenderness with motion of the cervix
- Adnexal tenderness

In addition to the above criteria, at least one of the following findings must also be present:

- Meets the surveillance case definition of *Chlamydia trachomatis* infection or gonorrhea
- Temperature greater than 38 C
- Leukocytosis greater than 10,000 WBC/mm3

- Purulent material in the peritoneal cavity obtained by culdocentesis or laparoscopy
- Pelvic abscess or inflammatory complex on bimanual examination or by sonography
- Patient is a sexual contact of a person known to have gonorrhea, chlamydia, or nongonococcal urethritis

Case classification

Confirmed: a case that meets the clinical case definition

Comment

For reporting purposes, a clinician's report of pelvic inflammatory disease should be counted as a case.

Pertussis

Clinical case definition

A cough illness lasting at least 2 weeks with one of the following: paroxysms of coughing, inspiratory "whoop," or post-tussive vomiting—and without other apparent cause (as reported by a health professional)

Laboratory criteria for diagnosis

- Isolation of *Bordetella pertussis* clinical specimen

Case classification

Probable: meets the clinical case definition, is not laboratory confirmed, and is not epidemiologically linked to a laboratory-confirmed case

Confirmed: a clinically compatible case that is laboratory confirmed or epidemiologically linked to a laboratory-confirmed case

Comment

The clinical case definition above is appropriate from endemic or sporadic cases. In outbreak settings, a case may be defined as a cough illness lasting at least 2 weeks (as reported by a health professional). Because direct fluorescent antibody testing of nasopharyngeal secretions has been shown in some studies to have low sensitivity and variable specificity (5,6), it should not be relied on as a criterion for laboratory confirmation.

Both probable and confirmed cases should be reported to NNDSS.

Plague

Clinical description

A disease characterized by fever and leukocytosis that present in one or more of the following principal clinical forms:

- Regional lymphadenitis (bubonic plague)
- Septicemia without an evident bubo (septicemic plague)
- Plague pneumonia, resulting from hematogenous spread in bubonic or septicemic cases (secondary plague pneumonia) or inhalation of infectious droplets (primary plague pneumonia)
- Pharyngitis and cervical lymphadenitis resulting from exposure to larger infectious droplets or ingestion of infected tissues (pharyngeal plague)
- Plague is transmitted to humans by fleas or by direct exposure to infected tissues or respiratory droplets.

Laboratory criteria for diagnosis

- Isolation of *Yersinia* pestis from a clinical specimen, or
- Fourfold or greater change in serum antibody to *Y. pestis*

Case classification

Probable: a clinically compatible illness with supportive laboratory results (demonstration of a single serologic test result suggestive of recent infection with no history of immunization, or demonstration of a Fraction I antigen in blood, bubo aspirate, or tissue by antigen detection—enzyme-linked immunosorben assay (ELISA) or fluorescent assay (FA))

Confirmed: a case that is laboratory confirmed

Poliomyelitis, Paralytic

Clinical case definition

Acute onset of a flaccid paralysis of one or more limbs with decreased or absent tendon reflexes in the affected limbs, without other apparent cause, and without sensory or cognitive loss (as reported by a physician)

Case classification

Probable: a case that meets the clinical case definition

Confirmed: a case that meets the clinical case definition and in which the patient has a neurological deficit 60 days after onset of initial symptom, has died, or has unknown follow-up status

Comment

All suspected cases of paralytic poliomyelitis are reviewed by a panel of expert consultants before final classification occurs. Only confirmed cases are included in Table 1 in the MMWR. Suspected cases are enumerated in a footnote to the MMWR table.

Psittacosis

Clinical description

An illness characterized by fever, chills, headache, photophobia, lower or upper respiratory disease, and myalgia

Laboratory criteria for diagnosis

- Isolation of *Chlamydia psittaci* from a clinical specimen, or
- Fourfold or greater increase in psittacosis complement-fixing (CF) antibody titer (greater than or equal to 32) between two serum specimens obtained greater than or equal to 2 weeks apart and studied at the same laboratory

Case classification

Probable: a clinically compatible illness that is epidemiologically linked to a confirmed case, or with supportive serology (i.e., a psittacosis CF titer of greater than or equal to 32 in one or more serum specimens obtained after onset of symptoms)

Confirmed: a clinically compatible illness that is laboratory confirmed

Comment

The serologic findings noted above may also occur as a result of infection with *Chlamydia trachomatis* or *Chlamydia pneumoniae.*

Rabies, Animal

Laboratory criteria for diagnosis

- A positive direct fluorescent antibody test (preferably performed on central nervous system tissue)
- Isolation of rabies virus (in cell culture or in a laboratory animal)

Case classification

Confirmed: a case that is laboratory confirmed

Rabies, Human

Clinical description

Rabies is an acute encephalomyelitis that almost always progresses to coma or death within 10 days of the first symptom.

Laboratory criteria for diagnosis

- Detection by direct fluorescent antibody of viral antigens in a clinical specimen (preferably the brain or the nerves surrounding hair follicles in the nape of the neck), or
- Isolation (in cell culture or in a laboratory animal) of rabies virus from saliva, cerebrospinal fluid (CSF), or central nervous system tissue, or
- Identification of a rabies-neutralizing antibody titer greater than or equal to 5 (complete neutralization) in the serum or CSF of an unvaccinated person

Case classification

Confirmed: a clinically compatible illness that is laboratory confirmed

Comment

Laboratory confirmation by all of the above methods is strongly recommended.

Reye Syndrome

Clinical case definition

An illness that meets all of the following criteria:

- Acute, noninflammatry encephalopathy that is documented clinically by a) an alteration in consciousness and, if available, b) a record of the CSF containing less than or equal to 8 leukocytes/mm3 or a histologic specimen demonstrating cerebral edema without perivascular or meningeal inflammation
- Hepatopathy documented by either a) a liver biopsy or an autopsy considered tbe diagnostic of Reye syndrome or b) a threefold or greater increase in the levels of the serum glutamic-oxaloacetic transaminase (SGOT), serum glutamic-pyruvic transaminase (SGPT), or serum ammonia
- No more reasonable explanation for the cerebral and hepatic abnormalities

Case classification

Confirmed: a case that meets the clinical case definition

Rheumatic Fever

Clinical description

An inflammatory illness that occurs as a delayed sequel to group A streptococcal infection
Major criteria: carditis, polyarthritis, chorea, subcutaneous nodules, and erythema marginatum
Minor criteria: a) previous rheumatic fever or rheumatic heart disease, b) arthralgia, c) fever, d) elevated erythrocyte sedimentation rate, positive C-reactive protein, or leukocytosis , and e) prolonged PR interval

Laboratory criteria for diagnosis

- No specific laboratory test exists for the diagnosis of rheumatic fever.

Case classification

Confirmed: an illness characterized by a) two major criteria or one major and two minor criteria (as described above) and b) supporting evidence of preceding group A streptococcal infection (7)

Comment

Supporting evidence to confirm streptococcal infection includes increased antistreptolysin-O or other streptococcal antibodies, throat culture positive for group A streptococcus, or recent scarlet fever. The absence of supporting evidence of preceding streptococcal infection should make the diagnosis doubtful, except in Sydenham chorea or low-grade carditis when rheumatic fever is first discovered after a long latent period from the antecedent infection.

Rocky Mountain Spotted Fever

Clinical description

An illness most commonly characterized by acute onset and fever, usually accompanied by myalgia, headache, and petechial rash (on the palms and soles in two-thirds of the cases)

Laboratory criteria for diagnosis

- Fourfold or greater rise in antibody titer to the spotted fever group antigen by immunofluorescent antibody (IFA), complement fixation (CF), latex agglutination (LA), microagglutination (MA), or indirect hemagglutination (IHA) test, or a single titer greater than or equal to 64 by IFA or greater than or equal to 16 by CF
- Demonstration of positive immunofluorescence of skin lesion (biopsy) or organ tissue (autopsy)
- Isolation of *Rickettsia rickettsii* from clinical specimen

Case classification

Probable: a clinically compatible case with supportive serology (fourfold rise in titer or a single titer greater than or equal to 320 by *Proteus* OX-19 or OX-2, or a single titer greater than or equal to 128 by LA, IHA, or MA test)
Confirmed: a case that is laboratory confirmed

Rubella

Clinical case definition

An illness with all of the following characteristics:

- Acute onset of generalized maculopapular rash
- Temperature greater than 37.2C (greater than 99 F), if measured
- Arthralgia/arthritis, or lymphadenopathy, or conjunctivitis

Cases meeting the measles case definition are excluded. Also excluded are cases with serology compatible with recent measles virus infection.

Laboratory criteria for diagnosis

- Isolation of rubella virus, or
- Significant rise in rubella antibody level by any standard serologic assay, or
- Positive serologic test for rubella IgM antibody

Case classification

Suspect: any generalized rash illness of acute onset

Probable: a case that meets the clinical case definition, has no or noncontributory serologic or virologic testing, and is not epidemiologically linked to a laboratory-confirmed case

Confirmed: a case that is laboratory confirmed or that meets the clinical case definition and is epidemiologically linked to a laboratory-confirmed case

Rubella Syndrome, Congenital

Clinical description

An illness of newborns resulting from rubella infection *in utero* and characterized by symptoms from the following categories:

(A) Cataracts/gongenital glaucoma, congenital heart disease, loss of hearing, pigmentary retinopathy

Associated symptoms may be:

(B) Purpura, splenomegaly, jaundice, microcephaly, mental retardation meningoencephalitis, radiolucent bone disease

Case definition

Presence of any defects or laboratory data consistent with congenital rubella infection (as reported by a health professional)

Laboratory criteria for diagnosis

- Isolation of rubella virus, or
- Demonstration of rubella-specific IgM antibody, or
- An infant's rubella antibody level that persists above and beyond that expected from passive transfer of maternal antibody (i.e., rubella HI titer that does not drop at the expected rate of a twofold dilution per month)

Case classification

Possible: a case with some compatible clinical findings but not meeting the criteria for a compatible case

Compatible: a case that is not laboratory confirmed and that has any two complications listed in (A) above, or one complication from (A) and one from (B)

Confirmed: a clinically compatible case that is laboratory confirmed

Comment

In compatible cases, either or both of the eye-related findings (cataracts and congenital glaucoma) count as a single complication.

Salmonellosis

Clinical description

An illness of variable severity commonly manifested by diarrhea, abdominal pain, nausea, and sometimes vomiting. Asymptomatic infections may occur, and the organism may cause extraintestinal infections.

Laboratory criteria for diagnosis

- Isolation of *Salmonella* from a clinical specimen

Case classification

Probable: a clinically compatible illness that is epidemiologically linked to a confirmed case
Confirmed: a case that is laboratory confirmed

Comment

Both probable and confirmed cases are reported to the NNDSS, but only confirmed cases are reported to the laboratory-based surveillance system operated by the Enteric Diseases Branch, Center for Infectious Diseases, CDC. Both asymptomatic infections and infections at sites other than the gastrointestinal tract, if laboratory confirmed, are considered confirmed cases.

Shigellosis

Clinical description

An illness of variable severity characterized bydiarrhea, fever, nausea, cramps, and tenesmus. Asymptomatic infections occur.

Laboratory criteria for diagnosis

- Isolation of *Shigella* from a clinical specimen

Case classification

Probable: a clinically compatible illness that is epidemiologically linked to a confirmed case
Confirmed: a case that is laboratory confirmed

Comment

Both probable and confirmed cases are reported to the NNDSS, but only confirmed cases are reported to the laboratory-based surveillance system operated by the Enteric Diseases Branch, Center for Infectious Diseases, CDC. Confirmation is based on laboratory findings, and clinical illness is not required.

Spinal Cord Injury

Clinical case definition

An acute traumatic lesion of the neural elements in the spinal canal, resulting in temporary or permanent sensory deficit, motor deficit, or bowel/bladder dysfunction

Case classification

Confirmed: a case that meets the clinical case definition

Syphilis

Syphilis is a complex, sexually transmitted disease with a highly variable clinical course. Classification by a clinician with expertise in syphilis may take precedence over the following case definitions developed for surveillance purposes.

Primary Syphilis

Clinical description

The characteristic lesion of primary syphilis is the chancre, but atypical primary lesions may occur.

Laboratory criteria for diagnosis

- Demonstration of *Treponema pallidum* in clinical specimens by darkfield, fluorescent antibody, or equivalent microscopic methods

Case classification

Probable: a clinically compatible case with one or more ulcers (chancres) consistent with primary syphilis and a reactive serologic test

Confirmed: a clinically compatible case that is laboratory confirmed

Secondary Syphilis

Clinical description

A stage of infection due to *Treponema pallidum*, characterized by localized or diffuse mucocutaneous lesions and generalized lymphadenopathy. Constitutional symptoms are common, and clinical manifestations are protean. The primary chancre may still be present.

Laboratory criteria for diagnosis

- Demonstration of *T. pallidum* in clinical specimens by darkfield, fluorescent antibody, or equivalent microscropic methods

Case classification

Probable: a clinically compatible case with a reactive nontreponemal (VDRL, RPR) test titer of greater than or equal to 4

Confirmed: a clinically compatible case that is laboratory confirmed

Latent Syphilis

Clinical description

A stage of infection due to *Treponema pallidum* in which organisms persist in the body of the infected person without causing symptom or signs. Latent syphilis is subdivided into early, late, and unknown syphilis categories based upon the length of elapsed time from initial infection.

Case classification

Presumptive: no clinical signs or symptoms of syphilis and the presence of one of the following:

- No past diagnosis of syphilis and a reactive nontreponemal test, and a reactive treponemal (fluorescent treponemal antibody-absorbed (FTA-ABS), microhemagglutination assay for antibody to *Treponema pallidum* (MHA-TP) test
- A past history of syphilis therapy and a current nontreponemal test titer demonstrating fourfold or greater increase from the last nontreponemal test titer

Early Latent Syphilis

Clinical description

A subcategory of latent syphilis. When initial infection has occurred within the previous 12 months, latent syphilis is classified as early.

Case classification

Presumptive: latent syphilis (see above) of a person who has evidence of having acquired the infection within the previous 12 months based on one or more of the following criteria:

- A nonreactive serologic test for syphilis or a nontreponemal titer that has dropped fourfold within the past 12 months
- A history of symptoms consistent with primary or secondary syphilis without a history of subsequent treatment in the past 12 months
- A history of sexual exposure to a partner with confirmed or presumptive primary or secondary syphilis, or presumptive early latent syphilis, and no history of treatment in the past 12 months
- Reactive nontreponemal and treponemal tests from an individual whose only possible exposure occurred within the preceding 12 months

Late Latent Syphilis

Clinical description

A subcategory of latent syphilis. When initial infection has occurred greater than 1 year previously, latent syphilis is classified as late.

Case classification

Presumptive: latent syphilis (see above) of a patient who shows no evidence of having acquired the disease within the past 12 months (see **Early Latent Syphilis**) and whose age and titer do not meet the criteria specified for unknown latent syphilis

Unknown Latent Syphilis

Clinical description

A subcategory of latent syphilis. When the date of initial infection cannot be established as occurring within the previous year, and the patient's age and titer meet criteria described below, latent syphilis is classified as unknown latent.

Case classification

Presumptive: latent syphilis (see above) that does not meet the criteria for early latent syphilis, and the patient is 13-35 years of age with a nontreponemal test serologic titer of greater than or equal to 32

Neurosyphilis

Clinical description

Evidence of CNS infection with *Treponema pallidum*

Laboratory criteria for diagnosis

- A reactive serologic test for syphilis and reactive VDRL in cerebrospinal fluid (CSF)

Case classification

Presumptive: syphilis of any stage, a negative VDRL in CSF, and both of the following:

- Elevated CSF protein or leukocyte count in the absence of other known causes of these abnormalities

- Clinical symptoms or signs consistent with neurosyphilis without other known causes for these clinical abnormalities

Confirmed: syphilis, of any stage, that meets the laboratory criteria for neurosyphilis

Congenital Syphilis

Clinical description

A condition caused by infection *in utero* with *Treponema pallidum*. A wide spectrum of severity exists, and only severe cases are clinically apparent at birth. An infant (less than 2 years) may have signs such as hepatosplenomegaly, characteristic skin rash, condyloma lata , snuffles, jaundice (non-viral hepatitis), pseudoparalysis, anemia, or edema (nephrotic syndrome and/or malnutrition). An older child may have stigmata such as interstitial keratitis, nerve deafness, anterior bowing of shins, frontal bossing, mulberry molars, Hutchinson teeth, saddle nose, rhagades, or Clutton joints.

Laboratory criteria for diagnosis

- Demonstration of *T. pallidum* by darkfield microscopy, fluorescent antibody, or other specific stains in specimens from lesions, placenta, umbilical cord, or autopsy material

Case classification

Presumptive: the infection of an infant whose mother had untreated or inadequately treated[2] syphilis at delivery, regardless of signs in the infant; or the infection of an infant or child who has a reactive treponemal test for syphilis and any one of the following:

- Any evidence of congenital syphilis on physical examination
- Any evidence of congenital syphilis on long bone x-ray
- A reactive cerebrospinal fluid (CSF) VDRL
- An elevated CSF cell count or protein (without other cause)
- A reactive test for fluorescent treponemal antibody absorbed-19S-IgM antibody

Confirmed: a case (among infants) that is laboratory confirmed

Comment

Congenital and acquired syphilis may be difficult to distinguish when a child is seropositive after infancy. Signs of congenital syphilis may not be obvious, and stigmata may not yet have developed.

Abnormal values for CSF VDRL, cell count, and protein, as well as IgM antibodies, may be found in either congenital or acquired syphilis. Findings on long bone x-rays may help, since x-ray changes in the metaphysis and epiphysis are considered classic for congenitally acquired disease. The decision may ultimately be based on maternal history and clinical judgment. The possibility of sexual abuse should be considered.

For reporting purposes, congenital syphilis includes cases of congenitally acquired syphilis among infants and children, as well as syphilitic stillbirths.

Syphilitic Stillbirth

Clinical case definition

A fetal death that occurs after a 20-week gestation or in which the fetus weighs greater than 500 g, and the mother had untreated or inadequately treated[2] syphilis at delivery

Comment

For reporting purposes, syphilitic stillbirths should be reported as cases of congenital syphilis.

Tetanus

Clinical case definition

Acute onset of hypertonia and/or painful muscular contractions (usually of the muscles of the jaw and neck) and generalized muscle spasms without other apparent medical cause (as reported by a health professional)

Case classification

Confirmed: a case that meets the clinical case definition

Toxic Shock Syndrome

Clinical case definition

An illness with the following clinical manifestations:

- Fever—temperature greater than or equal to 38.9 C (102 F)
- Rash—diffuse macular erythroderma
- Desquamation—1-2 weeks after onset of illness, particularly palms and soles
- Hypotension—systolic blood pressure less than or equal to 90 mm Hg for adults or less than fifth percentile by age for children less than 16 years of age; orthostatic drop in diastolic blood pressure greater than or equal to 15 mm Hg from lying to sitting, orthostatic syncope, or orthostatic dizziness
- Multisystem involvement—three or more of the following:
  - -- Gastrointestinal: vomiting or diarrhea at onset of illness
  - -- Muscular: severe myalgia or creatine phosphokinase level at least twice the upper limit of normal for laboratory
  - -- Mucous membrane: vaginal, oropharyngeal, or conjunctival hyperemia
  - -- Renal: blood urea nitrogen or creatinine at least twice the upper limit of normal for laboratory or urinary sediment with pyuria (greater than or equal to 5 leukocytes per high-power field) in the absence of urinary tract infection
  - -- Hepatic: total bilirubin, serum glutamic-oxaloacetic transaminase (SGOT), or serum glutamic-pyruvic transaminase (SGPT) at least twice the upper limit of normal for laboratory
  - -- Hematologic: platelets less than 100,000/mm3
  - -- Central nervous sysem: disorientation or alterations in consciousness without focal neurologic signs when fever and hypotension are absent
- Negative results on the following tests, if obtained:
  - -- Blood, throat, or cerebrospinal fluid cultures (blood culture may be positive for *Staphylococcus aureus*)
  - -- Rise in titer to Rocky Mountain spotted fever, leptospirosis, or measles

Case classification

Probable: a case with five of the six clinical findings described above

Confirmed: a case with all six of the clinical findings described above, including desquamation, unless the patient dies before desquamation could occur

Trichinosis

Clinical description

A disease caused by ingestion of larvae of *Trichinella spiralis* that has variable clinical manifestations. Common signs and symptoms among symptomatic persons include eosinophilia, fever, myalgia, and periorbital edema.

Laboratory criteria for diagnosis

- Demonstration of larvae of cysts of *T. spiralis* on muscle biopsy, or
- Positive serology for *T. spiralis*

Case classification

Confirmed: a clinically compatible illness that is laboratory confirmed

Comment

In an outbreak setting, at least one case must be laboratory confirmed. Associated cases should be reported as confirmed if the patient shared an epidemiologically implicated meal or ate an epidemiologically implicated meat product and has either a positive serology for trichinosis or a clinically compatible illness.

Tuberculosis

Clinical description

A chronic bacterial infection due to *Mycobacterium tuberculosis*, characterized pathologically by the formation of granulomas. The most common site of infection is the lung, but other organs may be involved.

Clinical casedefinition

A case that meets the following criteria:

- A positive tuberculin skin test
- Other signs and symptoms compatible with tuberculosis, such as an abnormal, unstable (worsening or improving) chest x-ray, or clinical evidence of current disease
- Treatment with two or more antituberculosis medications
- Completed diagnostic evaluation

Laboratory criteria for diagnosis

- Isolation of *M. tuberculosis* from a clinical specimen, or
- Demonstration of *M. tuberculosis* from a clinical specimen by DNA probe or mycolic acid pattern on high-pressure liquid chromatography, or
- Demonstration of acid-fast bacilli in clinical specimen when a culture has not been or cannot be obtained

Case classification

Confirmed: a case that is laboratory confirmed or, in the absence of laboratory confirmation, a case that meets the clinical case definition

Comment

A case should not be counted twice within any consecutive 12-month period. However, cases in which the patients had verified disease in the past should be reported again if the patients were discharged. Cases also should be reported again if they were lost to supervision for greater than 12 months and disease can be verified again.

Mycobacterial diseases other than those caused by *M. tuberculosis* should not be counted in tuberculosis morbidity statistics unless there is concurrent tuberculosis.

Tularemia

Clinical description

An illness characterized by several distinct forms, including:

- Ulceroglandular—cutaneous ulcer with regional lymphadenopathy
- Glandular—regional lymphadenopathy with no ulcer

- Oculoglandular—conjunctivitis with preauricular lymphadenopathy
- Intestinal—pharyngitis, intestinal pain, vomiting, and diarrhea
- Pneumonic—primary pleuropolmonary disease
- Typhoidal—febrile illness without early localizing signs and symptoms

Clinical diagnosis is supported by evidence or history of a tick or deerfly bite, exposure to tissues of a mammalian host of *Francisella tularensis*, or exposure to potentially contaminated water.

Laboratory criteria for diagnosis

- Isolation of *F. tularensis* from a clinical specimen, or
- Demonstration of *F. tularensis* in a clinical specimen by immunofluorescence , or
- Fourfold or greater rise in agglutination titer between acute- and convalescent-phase serum specimens obtained greater than or equal to 2 weeks apart, analyzed at the same time, and in the same laboratory

Case classification

Probable: a clinically compatible case with supportive serologic results (tularemia agglutination titer of greater than or equal to 160 in one or more serum specimens obtained after onset of symptoms)

Confirmed: a case that is laboratory confirmed

Typhoid Fever

Clinical description

An illness caused by *Salmonella typhi* that is often characterized by insidious onset of sustained fever, headache, malaise, anorexia, relative bradycardia, constipation or diarrhea, and nonproductive cough. However, many mild and atypical infections occur. Carriage of *S. typhi* may be prolonged.

Laboratory criteria for diagnosis

- Isolation of *S. typhi* from blood, stool, or other clinical specimen

Case classification

Probable: a clinically compatible illness that is epidemiologically linked to a confirmed case in an outbreak

Confirmed: a clinically compatible illness that is laboratory confirmed

Comment

Isolation of the organism is required for confirmation. Serologic evidence alone is not sufficient for diagnosis. Asymptomatic carriage should NOT be reported as typhoid fever. Isolates of *S. typhi* are reported to the Enteric Diseases Branch, Center for Infectious Diseases, CDC, through laboratory-based surveillance. (See ***Salmonella.***)

Varicella (Chickenpox)

Clinical case definition

An illness with acute onset of diffuse (generalized) papulovesicular rash without other apparent cause (as reported by a health professional)

Laboratory criteria for diagnosis

- Isolation of varicella virus from a clinical specimen, or
- Significant rise in varicella antibody level by any standard serologic assay

Case classification

Probable: a case that meets the clinical case definition, is not laboratory confirmed, and is not epidemiologically linked to another probable or confirmed case

Confirmed: a case that is laboratory confirmed or that meets the clinical case definition and is epidemiologically linked to a confirmed or probable case

Comment

Two probable cases that are epidemiologically linked would be considered confirmed, even in the absence of laboratory confirmation.

Waterborne Disease Outbreak

Clinical description

Symptoms of illness depend upon etiologic agent. (See *Guidelines for Confirmation of Foodborne and Waterborne Disease Outbreaks*, in press.)

Laboratory criteria for diagnosis

Depends upon etiologic agent. (See *Guidelines for Confirmation of Foodborne and Waterborne Disease Outbreaks*, in press.)

Definition

An incident in which two or more persons experience a similar illness after consumption or use of water intended for drinking, and epidemiologic evidence implicates the water as the source of the illness.

Comment

In addition, a single case of chemical poisoning constitutes an outbreak if laboratory studies indicate that the water has been contaminated by the chemical. Other outbreaks that should be reported included a) epidemiologic investigations of outbreaks of gastroenteritis (even if not waterborne) on ocean-going passenger vessels that call on U.S. ports, and b) outbreaks of illness associated with exposure to recreational water. Disease outbreaks associated with water used for recreational purposes should meet the same criteria used for waterborne outbreaks associated with drinking water. However, outbreaks associated with recreational water involve exposure to or unintentional ingestion of fresh or marine water, excluding wound infections caused by water-related organisms.

Yellow Fever

Clinical description

A mosquito-borne, viral illness characterized by acute onset and constitutional symptoms followed by a brief remission and a recurrence of fever, hepatitis, albuminuria, and symptoms and, in some cases, renal failure, shock, and generalized hemorrhages

Laboratory criteria for diagnosis

- Fourfold or greater rise in yellow fever antibody titer with no history of recent yellow fever immunization, and cross-reactions to other flaviviruses ruled out, or
- Demonstration of yellow fever virus, antigen, or genome in tissue, blood, or other body fluid

Case classification

Probable: a clinically compatible illness with supportive serology (stable elevated antibody titer to yellow fever virus, e.g., greater than or equal to 32 by complement fixation, greater than or equal to 256 by immunofluorescence assay, greater than or equal to 320 by hemagglutination inhibition, greater than or equal to 160 by neutralization, or a positive serologic result by IgM-capture enzyme immunoassay. Cross-reactive serologic reaction to other flaviviruses must be ruled out, and there must be no history of yellow fever immunization.)

Confirmed: a clinically compatible illness that is laboratory confirmed

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[1]Standard method (Wintrobe, 1967) utilizes a blood-pressure cuff to impede venous flow. A test is considered positive if there are greater than or equal to 20 petechiae/inch((2)).

[2]Inadequate treatment consists of any non-penicillin therapy or penicillin given less than 30 days before delivery.


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HAWAII
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ALASKA
PUERTO RICO
VIRGIN ISLANDS

NOTE

Pages 476-490 not used.

Appendix E
Abbreviated Compendium of
Acute Foodborne Gastrointestinal Disease

I. Diseases typified by vomiting after a short incubation period with little or no fever

Agent	Incubation period Usual (and Range)	Symptoms* (Partial list)	Pathophysiology	Characteristic foods	Specimens
A. *Staphylococcus aureus*	2-4 hours (1-6 hours)	N, C, V; D, F may be present	preformed enterotoxin	sliced/chopped ham and meats, custards, cream fillings	**Food:** enterotoxin assay (FDA), culture for quantitation and phage typing of staph, gram stain **Handlers:** culture nares, skin, skin lesions, and phage type staph **Cases:** culture stool and vomitus, phage type staph
B. Bacillus cereus	2-4 hours (1-6 hours)	N, V, D	? preformed enterotoxin	fried rice	**Food:** culture for quantitation **Cases:** stool culture
C. Heavy Metals 1. cadmium 2. copper 3. tin 4. zinc	5-15 minutes (1-60 minutes)	N, V, C, D		foods and beverages prepared/ stored/cooked in containers coated/ lined/contaminated with offending metal	Toxicologic analysis of food container, vomitus, stomach contents, urine, blood, feces

*B = bloody stools, C = cramps, D = diarrhea, F = fever, H = headache, N = nausea, V = vomiting, EM = electron microscopy, ELISA = enzyme-linked immunosorbent assay

II. Diseases typified by diarrhea after a moderate to long incubation period, often with fever

Agent	Incubation period Usual (and Range)	Symptoms* (Partial list)	Pathophysiology	Characteristic foods	Specimens
A. *Clostridium perfringens*	12 hours (8-16 hours)	C, D (V, F rare)	enterotoxin formed *in vivo*	meat, poultry	**Food:** enterotoxin assay done as research procedure by FDA, culture for quantitation and serotyping **Cases:** culture feces for quantitation and serotyping of *C. perfringens*; test for enterotoxin in stool **Controls:** culture feces for quantitation and serotyping of *C. perfringens*
B. *Salmonella* (non-typhoid)	12-36 hours (6-72 hours)	D, C, F, V, H septicemia or enteric fever	tissue invasion	poultry, eggs, raw milk, meat (cross-contamination important)	**Food:** culture with serotyping **Cases:** stool culture with serotyping **Handlers:** stool culture with serotyping as a secondary consideration
C. *Vibrio parahaemolyticus*	12 hours (2-48 hours)	C, D N, V, F, H, B	tissue invasion, ? enterotoxin	seafood	**Food:** culture on TCBS, serotype, Kanagawa test **Cases:** stool cultures on TCBS, serotype, Kanagawa test

*B = bloody stools, C = cramps, D = diarrhea, F = fever, H = headache, N = nausea, V = vomiting, EM = electron microscopy, ELISA = enzyme-linked immunosorbent assay

II. Diseases typified by diarrhea after a moderate to long incubation period, often with fever, continued

Agent	Incubation period Usual (and Range)	Symptoms* (Partial list)	Pathophysiology	Characteristic foods	Specimens
D. *Escherichia coli* enterotoxigenic	16-48 hours	D, C	enterotoxin	uncooked vegetables, salads, water, cheese	**Food:** culture and serotype **Cases:** stool cultures; serotype and entero-toxin production, invasiveness assay
Escherichia coli enteroinvasive	16-48 hours	C, D, F, H	tissue invasion	same	**Controls:** stool cultures; serotype & enterotoxin prod-uction. Look for common serotype in food & cases not found in controls; DNA probes
Escherichia coli enterohemorrhagic (E coli O157:H7 and others)	48-96 hours	B, C, D, H, F infrequent	cytotoxin	beef, raw milk, water	stool cultures on MacConkeys sorbitol; serotype
E. *Bacillus cereus*	8-16 hours	C, D	? enterotoxin	custards, cereals, puddings, sauces, meat loaf	**Food:** culture **Cases:** stool cultures
F. *Shigella*	24-48 hours	C, F, D B, H, N, V	tissue invasion	foods contaminated by infected food-handler; usually not foodborne	**Food:** culture and serotype **Cases:** stool culture & serotype **Handlers:** stool culture & serotype
G. *Yersinia enterocolitica*	3 to 5 days (usual) range unclear	F, D, C, V, H	tissue invasion, ? enterotoxin	pork products, foods contaminated by infected human or animal	**Food:** culture **Cases:** stool, blood cultures, serology **Handlers:** stool cultures

*B = bloody stools, C = cramps, D = diarrhea, F = fever, H = headache, N = nausea, V = vomiting, EM = electron microscopy, ELISA = enzyme-linked immunosorbent assay

II. Diseases typified by diarrhea after a moderate to long incubation period, often with fever, continued

Agent	Incubation period Usual (and Range)	Symptoms* (Partial list)	Pathophysiology	Characteristic foods	Specimens
H. *Vibrio cholerae* O1	24-72 hours	D, V	enterotoxin formed *in vivo*	shellfish, water or foods contaminated by infected person or obtained from contaminated environmental source	**Food:** culture on TCBS, serotype **Cases:** stool cultures on TCBS, serotype Send all isolates to CDC for confirmation and toxin assay.
I. *Vibrio cholerae* non-O1	16-72 hours	D, V	enterotoxin formed *in vivo?* tissue invasion	shellfish	**Food:** culture on TCBS, serotype **Cases:** stool cultures on TCBS, serotype
J. *Campylobacter jejuni*	3-5 days	C, D, B, F	unknown	raw milk, poultry, water	**Food:** culture on selective media (5%0_2, 42°C) **Cases:** culture on selective media (5%0_2, 42°C), serology
K. Parvovirus-like agents (Norwalk, Hawaii, Colorado, cockle agents)	16-48 hours	N, V, C, D	unknown	shellfish, water	Stool for immune EM and serology by special arrangement
L. Rotavirus	16-48 hours	N, V, C, D	unknown	foodborne transmission not well documented	**Cases:** stool examination by EM or ELISA; serology

*B = bloody stools, C = cramps, D = diarrhea, F = fever, H = headache, N = nausea, V = vomiting, EM = electron microscopy, ELISA = enzyme-linked immunosorbent assay

III. Botulism

Agent	Incubation period Usual (and Range)	Symptoms* (Partial list)	Pathophysiology	Characteristic foods	Specimens
Clostridium botulinum	12-72 hours	V, D Descending paralysis	preformed toxin	improperly canned or preserved foods that provide anaer-obic conditions	**Food:** toxin assay **Cases:** serum and feces for toxin assay by CDC or State Lab; stool culture for *C. botulinum*

IV. Diseases most readily diagnosed from the history of eating a particular type of food

A. Poisonous mushrooms	Variable	Variable		Wild mushrooms	**Food:** speciation by mycetologist
B. Other poisonous plants	Variable	Variable		Wild plant	**Cases:** vomitus, blood, urine **Food:** speciation by botanist; feces may sometimes be helpful in confirmation
C. Scombroid fish poisoning	5 minutes-1 hour	N, C, D, H, flushing, urticaria	histamine	Mishandled fish (i.e., tuna)	**Food:** Histamine levels
Ciguatera poisoning	1-6 hours	D, N, V, paresthesias, reversal of temperature sensation	ciguatoxin	Large ocean fish (i.e., barracuda, snapper)	**Food:** Stick test for ciguatoxin (not widely available)
D. Other poisonous food sources	Variable	Variable	Variable		

*B = bloody stools, C = cramps, D = diarrhea, F = fever, H = headache, N = nausea, V = vomiting, EM = electron microscopy, ELISA = enzyme-linked immunosorbent assay

APPENDIX F
INVESTIGATION OF A FOODBORNE OUTBREAK FORM

DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
CENTERS FOR DISEASE CONTROL
ATLANTA, GEORGIA 30333

CDC USE ONLY ☐☐☐☐ (1 - 4)

FORM APPROVED
OMB NO. 0920-0004

INVESTIGATION OF A FOODBORNE OUTBREAK

1. Where did the outbreak occur ?

State _____ (5 -6) City or Town _____ County _____

2. Date of outbreak: (Date of onset 1st case)

_____ MO / DA / YR (7 - 12)

3. Indicate actual (a) or estimated (e) numbers:

Persons exposed _____ (13 - 17)

Persons ill _____ (18 - 22)

Hospitalized _____ (23 - 27)

Fatal case _____ (28 - 31)

4. History of Exposed Persons:

No. histories obtained _____ (32 - 35)

No. persons with symptoms _____ (36 - 39)

Nausea _____ (40 - 43) Diarrhea _____ (44 - 47)

Vomiting _____ (48 - 51) Fever _____ (52 - 55)

Cramps _____ (56 - 59) Other, specify _____

_____ (60 - 79)

5. Incubation period (hours):

Shortest _____ (80 - 83) Longest _____ (84 - 87)

Approx. for majority _____ (88 - 91)

6. Duration of illness (hours):

Shortest _____ (92 - 95) Longest _____ (96 - 99)

Approx. for majority _____ (101 - 104)

7. Food - specific attack rates:

Food Items Served	Number of persons who ATE specified food				Number who did NOT eat specified food			
	Ill	Not Ill	Total	Percent Ill	Ill	Not Ill	Total	Percent Ill

8. Vehicle responsible (food item incriminated by epidemiological evidence): (105 - 106) _____

9. Manner in which incriminated food was marketed: (Check all Applicable)

	Yes 1	No 2	
(a) Food Industry			
Raw	☐	☐	(107)
Processed	☐	☐	(108)
Home Produced			
Raw	☐	☐	(109)
Processed	☐	☐	(110)
(b) Vending Machine	☐	☐	(111)
(c) Not wrapped	☐	☐	(112)
Ordinary Wrapping	☐	☐	(113)
Canned	☐	☐	(114)
Canned - Vacuum Sealed	☐	☐	(115)
Other (specify)	☐	☐	(116)
			(117 - 129)
(d) Room Temperature	☐	☐	(130)
Refigerator	☐	☐	(131)
Frozen	☐	☐	(132)
Heated	☐	☐	(133)

If a commerical product, indicate brand name and lot number

_____ (134 - 150)

10. Place of Preparation of Contaminated Item: (151)

Restaurant	☐ 1
Dedicatessen	☐ 2
Cafeteria	☐ 3
Private Home	☐ 4
Picnic	☐ 5
Institution:	
School	☐ 6
Church	☐ 7
Camp	☐ 8
Other, specify	☐ 9

_____ (152 - 171)

11. Place where eaten: (172)

Restaurant	☐ 1
Dedicatessen	☐ 2
Cafeteria	☐ 3
Private Home	☐ 4
Picnic	☐ 5
Institution:	
School	☐ 6
Church	☐ 7
Camp	☐ 8
Other, specify	☐ 9

_____ (173 - 192)

This questionnaire is authorized by law (Public Health Service Act. 42 USC §241). Although response to the questions asked is voluntary, cooperation of the patient is necessary for the study and control of the disease. Public reporting burden for this collection of information is estimated to average 15 minutes per response. Send comments regarding this burden estimate of any other aspect of this collection of information, including suggestions for reducing this burden to PHS Reports Clearance Officer: Rm 721-H, Humphrey Bg: 200 Independence Ave. SW; Washington, DC 202001; ATTN: PRA, and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503.

CDC 52.13 REV. 9/88

APPENDIX G
CASE REPORT FORMS FOR EXERCISE 6.3

STATE DISEASE REPORT FORM

NAME Ring, K.		AGE 29	PHONE 555-3631
ADDRESS 52 Eufala Rd.		SEX M	RACE W
CITY, STATE Columbia		COUNTY Columbia	
DISEASE Probable Trichinosis	DATE OF ONSET 7/23		LAB CONFIRMED? Not Done
HOSPITAL ALERTED? No	HOSPITAL NAME	ADMISSION DATE	DISCHARGE DATA
LAB TEST RESULTS Eosinophil Count 24% of total WBC's			
COMMENTS (Clinical description, immunization theory, etc.)			
POSSIBLE EXPOSURE Cleveland - McKay Wedding			
PHYSICIAN REPORTING Dr. Goodman		PHONE 555 3636	DATE OF REPORT 8/14

STATE DISEASE REPORT FORM

NAME McDowell, D.		AGE 33	PHONE 555-3707
ADDRESS 2020 Alabama		SEX M	RACE W
CITY, STATE Columbia		COUNTY Columbia	
DISEASE Trichinosis	DATE OF ONSET 7/27		LAB CONFIRMED? Muscle Biopsy
HOSPITAL ALERTED? Yes	HOSPITAL NAME Columbia General	ADMISSION DATE 7/27	DISCHARGE DATA 7/30
LAB TEST RESULTS Eosinophilia = 2500			
COMMENTS (Clinical description, immunization theory, etc.)			
POSSIBLE EXPOSURE Cleveland McKay Wedding			
PHYSICIAN REPORTING Dr. Baker		PHONE 555-1900	DATE OF REPORT 8/17

STATE DISEASE REPORT FORM

NAME Gordon, Jack		AGE 26	PHONE 556 1213
ADDRESS 110 Clifton Street		SEX M	RACE W
CITY, STATE Columbia		COUNTY Columbia	
DISEASE Probable Trichinosis	DATE OF ONSET 8/14		LAB CONFIRMED? No
HOSPITAL ALERTED? No	HOSPITAL NAME	ADMISSION DATE	DISCHARGE DATA
LAB TEST RESULTS Eosinophils = 37%			
COMMENTS (Clinical description, immunization theory, etc.)			
POSSIBLE EXPOSURE Cleveland McKay Wedding			
PHYSICIAN REPORTING Dr. Gibbs		PHONE 555-3841	DATE OF REPORT 8/14

STATE DISEASE REPORT FORM

NAME Dickens, R.		AGE 45	PHONE 555-2662
ADDRESS 34 Winifred Ave.		SEX M	RACE
CITY, STATE Seattle, WA		COUNTY King	
DISEASE Trichinosis	DATE OF ONSET 7/25		LAB CONFIRMED? Serologic
HOSPITAL ALERTED? No	HOSPITAL NAME	ADMISSION DATE	DISCHARGE DATA
LAB TEST RESULTS Eosinophils = 4100			
COMMENTS (Clinical description, immunization theory, etc.)			
POSSIBLE EXPOSURE Cleveland McKay Wedding			
PHYSICIAN REPORTING Dr. Webster		PHONE 555-0511	DATE OF REPORT 8/15

STATE DISEASE REPORT FORM

NAME Thomas Nancy		AGE 27	PHONE 555-3761
ADDRESS		SEX F	RACE W
CITY, STATE		COUNTY Columbia	
DISEASE Trichinosis	DATE OF ONSET 8/4		LAB CONFIRMED? No
HOSPITAL ALERTED? No	HOSPITAL NAME	ADMISSION DATE	DISCHARGE DATA
LAB TEST RESULTS 18% Eosinophilia			
COMMENTS (Clinical description, immunization theory, etc.)			
POSSIBLE EXPOSURE Cleveland - McKay Wedding			
PHYSICIAN REPORTING Dr Stanley		PHONE 555-0400	DATE OF REPORT 8/15

STATE DISEASE REPORT FORM

NAME McKay, Alice		AGE 54	PHONE 555-6256
ADDRESS 406 Tugalo Lane		SEX F	RACE W
CITY, STATE Brighton		COUNTY Clayton	
DISEASE R/o Trichinosis	DATE OF ONSET 8/11		LAB CONFIRMED? Serology Pending
HOSPITAL ALERTED? Yes	HOSPITAL NAME Columbia General	ADMISSION DATE 8/14	DISCHARGE DATA
LAB TEST RESULTS Eosinophils = 3600			
COMMENTS (Clinical description, immunization theory, etc.)			
POSSIBLE EXPOSURE Cleveland McKay Wedding			
PHYSICIAN REPORTING Dr. Mason		PHONE 555-3291	DATE OF REPORT 8/15

Appendix H
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Lesson Three

Table 3.6 Self-reported average number of cigarettes smoked per day, survey of public health students

Table 3.7 Blood lead levels* of children < 6 years old, random sample survey, Jamaica, 1987

Lesson Four

Table 4.1a Primary and secondary syphilis morbidity by age, United States, 1989

Table 4.1b Primary and secondary syphilis morbidity by age, United States, 1989

Table 4.1c Primary and secondary syphilis morbidity by age, United States, 1989

Table 4.2 Newly reported cases of primary and secondary syphilis by age and sex, United States, 1989

Table 4.3 Follow-up status among diabetic and nondiabetic white men, NHANES follow-up study, 1982-1984

Table 4.4 General format for 2 x 2 table

Table 4.5 Primary and secondary syphilis morbidity by age, race, and sex, United States, 1989

Table 4.6 Characteristics of residents of Nursing Home A during outbreak of diarrheal disease, January, 1989

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Table 4.11 Measles (rubeola) rate per 100,000 population, United States, 1955-1990

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List of Figure Titles

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Appendix J
Answers to Self-Assessment Quizzes

In grading your quiz, an answer is correct if you circle all the correct choices for that particular question. Each correct answer is worth 4 points. If an answer to a question is covered throughout the lesson and is not on specific pages, no page number is referenced.

Self-Assessment Quiz 1 – Answers

1. The correct answer is A. "Distribution" refers to the frequency and pattern of health events in a population. "Determinants" refer to causes.

   Reference: page 2

2. The correct answer is E. **Descriptive epidemiology** provides the *what, who, when,* and *where* of health-related events. **Analytic epidemiology** provides the *why*.

   Reference: page 2

3. The correct answer is C. John Snow conducted the investigation of the Golden Square cholera outbreak. John Graunt published an analysis of mortality data in 1662. William Farr was a contemporary of John Snow who made important contributions in the areas of vital statistics. Richard Doll and Austin Bradford Hill conducted the seminal studies of smoking and lung cancer in the 1950's.

   Reference: page 4

4. Clinical criteria
   Time
   Place
   Person

   Reference: page 12

5. The correct answer is C. An epidemic curve is a histogram of number of cases by date of onset traditionally used to display the course of an outbreak. Secular trend refers to the pattern over many years. Seasonal trend refers to the characteristic seasonal pattern exhibited by many diseases. There is no such thing as an "endemic curve."

   Reference: page 19

6. _F_ ID number

7. _A_ Disease code

8. _D_ Race

9. _C_ County

10. B Date of onset

11. B Date of report

12. A Outcome (alive or dead)

13. The correct answer is C.

    Reference: page 24

14. The correct answer is D. Educational achievement, family income, and occupation are used because they are easy to measure. Social standing is not.

    Reference: page 27

15. The correct answers are B and C. The Framingham study is an observational study rather than an experimental study or clinical trial because the investigators do not attempt to influence the subjects' choices; they simply observe and measure. It is a cohort study rather than a case-control study because the Framingham subjects were enrolled, classified by exposure, then followed for evidence of disease.

    Reference: page 33

16. The correct answers are B and D. The CASH study is an observational study rather than an experimental study or clinical trial because the investigators did not attempt to influence the subjects' choices; they simply asked about past use. It is a case-control study rather than a cohort study because the CASH subjects were enrolled on the basis of whether or not they had disease, then asked about exposure.

    Reference: page 33

17. The correct answer is B. The hallmark of an experimental study is that the investigator dictates each subject's exposure. In an observational study, the investigator observes, measures, or asks about the exposure, but does not dictate it.

    Reference: page 32

18. The correct answers are C and D. Only components C and D are present in every causal pie. Both components C and D are **necessary** causes, since disease cannot occur if either is absent.

    Reference: page 38

19. The correct answers are A, B, C, and D. Public health surveillance includes the collection, analysis, interpretation, and dissemination of health data **to be used for appropriate public health action**, but surveillance does not include the action itself.

    Reference: page 40

20. C Onset of symptoms
    D Usual time of diagnosis
    A Exposure

    Reference: page 43

21. The correct answer is A, droplet spread. Airborne, vehicleborne, and vectorborne transmission are all types of **indirect transmission**.

    Reference: page 47

22. B Community A: usually 10 cases / week; last week, 28 cases

23. C Community B: 50–70 cases / week; last week, 55 cases

24. A Community C: usually 25 cases / week; last week, 28 cases

    Reference: page 55

25. The correct answer is C, point source. Only a point source consistently produces the classic pattern described above. Other modes of spread yield epidemic curves which are more spread out and irregular.

    Reference: page 56

Self-Assessment Quiz 2 – Answers

1. The correct answer is **frequency distribution**.

   Reference: page 75

2. The correct answers are B and E. **Nominal scale** refers to values which are named rather than rank-ordered. The possible values of sex are male and female; the possible values of "Were you hospitalized in the last week?" are yes, no, and, perhaps, "don't know/don't remember." These values are named but are not rank-ordered in a mathematical sense.

   Ordinal scale refers to values along a numerical scale, with a natural rank order. Titers (with values such as 2, 4, 8, 16, etc.), parity, and height in centimeters all take ordered, numerical values.

   Reference: page 76

3. The correct answer is C. Frequency distributions can be used to summarize either nominal scale or ordinal scale variables. For ordinal scale variables which can take a wide range of values, the possible values can be grouped into a manageable number of class intervals.

   Reference: page 76

4. The only correct answer is A. The numerator is not a subset of the denominator, so the fraction is not a proportion. The denominator is not the population from which the cases in the numerator arose, so the fraction is not a rate.

   Reference: page 77

5. The correct answers are A and B. The numerator (women who died from heart disease) is a subset of the denominator (women who died from any cause), so the fraction is a proportion. The denominator is not the population from which the cases in the numerator arose, so the fraction is not a rate.

   Reference: page 77

6. The correct answers are A and D. The numerator (women who died from heart disease) is not a subset of the denominator (U.S. female population), because some of women who died did so before midyear. Therefore, the fraction is not a proportion. Since the denominator is the population at midyear rather than at the beginning of the year, the fraction is a mortality rate but not an attack rate.

   Reference: pages 77, 89, 100

7. The correct answer is A. The primary difference between incidence and prevalence is in what cases are included in the numerator. For incidence, the numerator is restricted to new cases. For prevalence, the numerator includes both new and pre-existing cases.

   Reference: page 86

8. The correct answer is D. The primary difference between point prevalence and period prevalence is in the time period of reference. Point prevalence reflects the presence of an attribute at a moment in time. A telephone interviewer might ask, “Do you currently have a disability that limits your day-to-day activities?” Period prevalence reflects presence of an attribute over a period in time. A telephone interviewer might ask, “At any time during the past year, including the present, do you or did you have a disability that limited your day-to-day activities?”

   Reference: page 86

9. The correct answers are B and D. Prevalence is based on both incidence and duration. If the incidence of the two diseases is similar, then the difference in prevalence must reflect a difference in duration. Since Disease A is more prevalent than Disease B, the duration of Disease A must be longer and the duration of Disease B must be shorter. Two possible explanations for Disease B’s shorter duration are rapid recovery or rapid mortality.

   Reference: page 87

10. The correct answer is A. In an epidemic setting, probability or risk is measured by an attack rate. The denominator of an attack rate is the initial size of the population at risk.

    Reference: page 89

11. The correct answer is D. The attack rate is calculated as (39 / 87) × 100 = 44.8% or 44.8/100.

    Reference: page 89

12. The correct answer is B. Eighty affected households, so 80 primary cases, so 120 – 80 = 40 secondary cases. The population at risk for becoming a secondary case is 480 – 80 = 400. Thus, the secondary attack rate = 40 / 400 = 10.0%.

    Reference: pages 89–90

13. The correct answer is E. If 49,990 persons remained disease-free for 2 years, they would contribute 99,980 person-years. If we assume that the 10 persons who developed Disease C did so midway through the 2 years, they would have contributed only 1 year each of disease-free follow-up. The denominator should then be 99,980 + 10 = 99,990, or approximately 100,000.

    Reference: pages 92–93

14. When investigators obtain information from (or about) all participants in an outbreak setting, the relative risk is calculated as the ratio of the attack rates. Therefore, the attack rate is (36 / 48) / (3 / 39), or 75.0% / 7.7%, or 9.7. Note that the odds ratio is (36 × 36) / (12 × 3), or 36, which is not close at all to the relative risk! The odds ratio approximates the relative risk only if the disease is rare, say less than 5%. In this setting, the disease was very common, affecting 44.8% of the participants!

    Reference: pages 93–94

15. The correct answer is D. Since this is a case-control study, we calculate an odds ratio as an estimate of the relative risk. The data from this case-control study can be arranged in the following two-by-two table:

	Case	Control	Total
Exposed	a = 50	b = 25	75
Unexposed	c = 50	d = 75	125
Total	100	100	200

    The odds ratio is calculated as ad / bc, or (50 × 75) / (25 × 50), which equals 3.0.

    Reference: pages 96–97

16. The correct answer is D. The numerator includes pre-existing cases, so we know we are dealing with prevalence rather than incidence. Both numerator and denominator are measured at a point in time (July 1, 1991), so it is point prevalence rather than period prevalence.

    Reference: page 86

17. The correct answer is A.

    Reference: page 93

18. The correct answer is C. Attack rates are usually expressed as percentages.

    Reference: page 89

19. The correct answer is F.

    Reference: page 83

20. The correct answer is D.

    Reference: page 101

21. The correct answers are A and E. The denominator for both the crude and the cause-specific mortality rates is the total size of the midyear population among which the deaths occurred. Age-specific, sex-specific, and race-specific mortality rates all use denominators which are restricted by age group, sex, and race, respectively.

    Reference: page 101

22. The correct answers are A, B, C, and D. The denominator for all of these measures is the number of live births during the same time period as the deaths in the numerator.

    Reference: pages 101–102

23. The only correct answer is E. We are not given the total number of deaths in 1987, so we cannot calculate the proportionate mortality due to either diabetes or liver disease. We are not given U.S. population data, so we cannot calculate any type of mortality rate or mortality rate ratio. Since we need only the number of deaths in each age group to calculate YPLL (to age 65), we can do so with these data. Without population data, however, we cannot calculate YPLL rates.

    Reference: page 112

24. The correct answer is C. Neonatal mortality rate refers to deaths from birth through 27 days of life. The denominator is the number of live births during the same time period. So the neonatal mortality rate for the data shown above is:

    $= ((400 + 300 + 300) / 100{,}000) \times 1{,}000$
    $= (1{,}000 / 100{,}000) \times 1{,}000$
    = 10.0 per 1,000 live births

    Reference: page 101

25. The only correct answer is D. The YPLL rate is the years of potential life lost divided by the population under age 65 years. Choices A and C would account for higher total YPLL, but not a higher YPLL *rate*. Choice B is irrelevant, since YPLL is unaffected by those over age 65 years. If age-specific mortality rates are higher in State A than in State B, then all else being equal, more deaths per population will occur in State A.

    Reference: pages 112–114

Self-Assessment Quiz 3 – Answers

1. The correct answer is E. The arithmetic mean, geometric mean, median, and mode are all measures of central location. The range is a measure of dispersion.

   Reference: pages 153–166

2. The correct answer is C. The median is at the half-way point of a set of data that has been arranged in rank order.

   Reference: page 156

3. The correct answer is A. The arithmetic mean is the most commonly used measure of central location because it has many desirable statistical properties.

   Reference: page 155

4. The correct answer is D. Class intervals must not overlap. With overlapping class intervals, the reader does not know whether a 5-year-old is counted in the 1–5 row or in the 5–15 row. The class intervals should read:

<1	25–34	65–74
1–4	35–44	75–84
5–14	45–54	≥85
15–24	55–64	Unknown

   Reference: page 147

5. The correct answer is B. The range, interquartile range, standard deviation, and variance are all measures of dispersion. A percentile is at a particular point in a ranked set of data. It is not a measure of dispersion even though it is used to determine the interquartile range.

   Reference: pages 169–179

6. The correct answers are A and C. The tail rather than the peak "defines" the direction of the skew. Thus, a distribution with a tail off to the left and a central location to the right is said to be **negatively skewed** or **skewed to the left**.

   Reference: page 149

7. The correct answer is A. The arithmetic mean is the measure of central location most sensitive to extreme values.

   Reference: page 156

8. The correct answer is D. The mode is the value that occurs most often in a set of data.

   Reference: page 159

9. The correct answer is B. The geometric mean is appropriate for variables which follow an exponential or logarithmic pattern, such as titers and dilutions. The geometric mean is also commonly used by environmental epidemiologists as a measure of central location for environmental samples.

   Reference: page 164

10. The correct answer is B. Because the range is the difference between the largest and smallest values, it is directly affected by extreme values.

    Reference: page 167

11. The correct answer is C. The interquartile range represents the difference between the 75th percentile (third quartile) and the 25th percentile (first quartile).

    Reference: page 169

12. The correct answer is C. The standard deviation is the measure of dispersion most commonly used with the arithmetic mean.

    Reference: page 179

13. The correct answers are A and E. 1.96 standard deviations below and above the mean correspond to the central 95%, with 2.5% remaining outside in each tail.

    Reference: page 177

14. The correct rank is D < A < B < C.

    D. Interquartile range (25th to 75th percentile) includes 50% of data
    A. Mean ± 1 s.d. (roughly 16th to 84th percentile) includes 68.3% of data
    B. 5th to 95th percentile includes 90% of data
    C. Mean ± 1.96 s.d. (2.5th to 97.5th percentile) includes 95% of data

    Reference: page 177

15. The correct answer is A. Interquartile range has same units as the raw data.

    Reference: page 167

16. The correct answer is C. Variance is based on squared differences, and has squared units.

    Reference: page 179

17. The correct answer is A. Standard error has same units as the raw data.

    Reference: pages 180–181

18. The correct answer is 20.
    Arithmetic mean = (14 + 10 + 9 + 11 + 17 + 20 + 7 + 90 + 13 + 9) / 10
    = 200 / 10
    = 20
    Reference: page 153

19. The correct answer is 11.5.
    Ordered data: 7, 9, 9, 10, 11, 13, 14, 17, 20, 90
    Middle rank is at (N + 1) / 2, or (10 + 1) / 2, or 5.5, halfway between 5th and 6th position
    Therefore, median is average of 5th and 6th values: (11 + 13) / 2 = 12
    Reference: page 157

20. The correct answer is 9.
    Ordered data: 7, 9, 9, 10, 11, 13, 14, 17, 20, 90
    The data set contains two 9s. No other value appears more than once.
    Reference: page 160

21. The correct answer is 83 (or, from 7 to 90).
    Ordered data: 7, 9, 9, 10, 11, 13, 14, 17, 20, 90
    Range = maximum – minimum = 90 – 7 = 83.
    Reference: page 167

22. The correct answer is C. The most appropriate measure of central location for skewed data is the median. When we use a median, we usually choose the interquartile range as our measure of dispersion.

23. The correct answer is E. Since all observations have the same value, the mean = 90, the difference between each observation and the mean = 0, and the variance and standard deviation = 0! In other words, since there is no variability from the mean, the measures of variability/dispersion equal 0!
    Reference: page 177

24. The correct answer is D. The standard error of the mean measures the variability of the distribution of sample means about the true population mean. It is a measure of the uncertainty / confidence we have in our sample mean as an estimate of the population mean.
    Reference: pages 180–181

25. The correct answer is C. The 95% confidence limits are calculated as the mean ± 1.96 standard errors of the mean (not standard deviations). Thus, the lower confidence limit is $89.5 - (1.96 \times 0.7)$, or 88.1. The upper limit is $89.5 + (1.96 \times 0.7)$, or 90.9.

    Reference: pages 183–184

Self-Assessment Quiz 4 – Answers

1. The correct answers are B, C, and D. Tables, graphs, and charts are important for summarizing, analyzing, and presenting data. While data are occasionally collected using a table (for example, counting observations by putting tick marks in particular cells in a table), this is not a common epidemiologic technique.

    Reference: page 206

2. The correct answer is C. In choice A, cells b and c are reversed. In choice B, the row and column totals are reversed. (Remember H for horizontal and V for vertical.) In choice D, the row and column headings are reversed.

    Reference: page 210

3. The correct answer is A. The table shows counts by only one variable: age group. Columns three and four display the counts in percentages and cumulative percentages, but they still refer to the same one variable.

    Reference: page 208

4. The correct answer is C. The maximum number of variables that can be shown in cross-tabular form in a single table is three. Even a three-variable table can appear busy.

    Reference: page 210

5. The correct answer is B. We create table shells when we design the analysis. This step should be part of the overall study plan or protocol. It should certainly come before questionnaire design. (The questionnaire should gather the information you need for your analysis!)

    Reference: page 214

6. The correct answers are A, B, C, D, and E. All of these methods are appropriate and commonly used by epidemiologists.

    Reference: pages 218–220

7. The correct answers are A, B, and D. A is based on the mean and standard deviation. The first interval only includes 0.0 because the upper limit was a negative value. B is based on creating three groups with an equal number of observations in each. D is based on creating four class intervals of equal size. C does not match any of the recommended methods.

    Reference: pages 218–220

8. The correct answer is C. On each axis of an arithmetic-scale line graph, equal distances represent equal quantities. Choices A, B, and D all refer to semilogarithmic-scale line graphs.

   Reference: pages 227–232

9. The correct answers are A and B. Line graphs are recommended for showing long-term trends, particularly of rates. An arithmetic scale is adequate if the annual Disease Z mortality rates have been fairly stable. A semilogarithmic scale may be preferred if the rates have varied over more than one order of magnitude.

10. The correct (inappropriate) answer is B. B represents an arithmetic progression of numbers, in which the distance between each two consecutive numbers is equal. The other choices represent logarithmic progressions.

    Reference: page 232

11. The correct answer is D. The *x*-axis of a histogram is used for continuous variables such as time. Thus the columns of a histogram are continuous, i.e., without spaces. In contrast, the *x*-axis of a bar chart is used for noncontinuous variables such as sex, or continuous variables grouped into discrete categories such as ten-year age groups. Therefore, the columns are discontinuous, i.e., with spaces between them.

    Reference: page 247

12. The only correct answer is A. An epidemic curve is a histogram, with number of cases on the *y*-axis and date of *onset*, not exposure. The curve should begin with a pre-epidemic period to illustrate the background level of disease. The class interval on the *x*-axis should be about 1/4 (1/8 to 1/3) of the average incubation period for the disease under study.

    Reference: page 239

13. The correct answer is A. The frequency polygon should begin and end at the midpoint of the class intervals outside the most extreme values of the distribution being graphed.

    Reference: page 242

14. The correct answers are B, C, and D. A histogram could be used to show the number of deaths by year (or five years or ten years). A cumulative frequency curve could be used to show the cumulative number of deaths, up to the maximum of 100 when the last alumnus dies. A survival curve could be used to show the decline over time from 100% of the cohort to 0% when the last alumnus dies.

    Reference: pages 236, 243

15. The correct answer is E.

    Reference: page 241

16. The correct answer is B.

    Reference: page 246

17. The correct answer is A.

    Reference: page 227

18. The correct answer is C.

    Reference: page 257

19. The correct answer is F.

    Reference: page 245

20. The correct answer is D.

    Reference: page 257

21. The correct answer is B. A semilogarithmic-scale line graph is ideal for showing and comparing rates of change.

    Reference: page 233

22. The correct answer is B. Since we know only names of places but not their position on a map, place is not a continuous variable. Therefore, we would simply show numbers of cases by place with a bar chart.

    Reference: page 246

23. The correct answers are B, C, and D. We need to display the frequency of two variables: cause and sex. A grouped bar chart or stacked bar chart or 100% component bar chart (with two bars, one for each sex) can display the relative size of the component causes of death. Simple bar charts and pie charts are usually restricted to components of one variable.

    Reference: pages 247–250

24. The correct answer is A. The measure we call “years of potential life lost” (YPLL) is a derivative of the number of deaths. To display YPLL by cause (one variable), we can use a simple bar chart.

    Reference: page 247

25. The only correct answer is B. The major disadvantage of a spot map is that it does not take into account the size of the population when it shows number of cases. In other words, a spot map cannot portray rates, but an area map can. On the other hand, a spot map can pinpoint location more precisely than an area map. Both spot maps and area maps can show numbers of cases, including several cases in the same location. An area map can use different shades to show different numbers. A spot map can use different symbols or different sizes of the same symbol to show different numbers in one location.

    Reference: pages 254–255

Self-Assessment Quiz 5 – Answers

1. The correct answers are A, B, C, and D. Public health surveillance includes data collection, analysis, interpretation, and dissemination, so that the appropriate persons and programs can conduct the appropriate interventions, e.g., prevention and control. Surveillance, however, does not include the prevention and control activities themselves.

   Reference: page 290

2. The correct answer is B. Public health surveillance refers to the monitoring of health events in populations. Medical surveillance refers to the monitoring of potentially exposed individuals to detect early symptoms.

   Reference: page 291

3. The correct answer is A. Surveillance for communicable diseases tends to rely on the notifiable disease reporting system. The reports are submitted specifically for surveillance purposes. Surveillance for chronic diseases tends to rely on analysis of data collected for other reasons (“secondary data analysis”).

   Reference: page 292

4. The correct answers are A, B, C, D, and E. Surveillance data are used primarily for monitoring health events and guiding public health action. Monitoring health events includes detecting abrupt changes and long-term trends in disease, changes in agents and host factors, and changes in health care practice. Guiding public health action includes providing direction for investigation and control efforts, planning and resource allocation, evaluation, and research.

   Reference: pages 293–296

5. The correct answer is B. Vital statistics include data on birth, death, marriage, and divorce. So vital statistics are the primary source of data on mortality.

   Reference: page 297

6. The correct answers are A, B, and C. Sources of morbidity (illness) data include notifiable disease reports, laboratory data, hospital data, outpatient health care data, and surveillance systems for specific health conditions such as cancer. Vital records are an important source of mortality data. Environmental monitoring data are an important source of data for disease potential or risk.

   Reference: pages 298, 301

7. The correct answer is E. Surveillance of animal populations is used to assess the risk or potential for disease in humans by detecting
   - changes in the size and distribution of animal reservoirs and vectors
   - morbidity and mortality in animals caused by agents that can affect humans
   - prevalence in animals of agents that can infect humans, even if the animals remain unaffected

   However, surveillance of animal populations is not usually intended to serve as a substitute for surveillance of morbidity in humans.

   Reference: page 300

8. The correct answer is B. The list of reportable diseases is set by the state — either the state legislature, state board of health, state health department, state health officer, or state epidemiologist.

   Reference: page 303

9. The correct answers are A, B, C, and D. The state regulations typically specify the diseases and conditions that must be reported, who must submit reports, how and to whom the case reports are to be sent, and what information is to be provided. Some statutes and regulations also specify control measures to be taken and penalties for not reporting.

   Reference: page 303

10. The correct answer is E. The number of nationally notifiable diseases was 45 in 1990. The number has grown during the past decade, with the addition of AIDS, invasive *Hemophilus influenzae* infection, Legionnaires' disease, Lyme disease, and toxic shock syndrome.

    Reference: page 304

11. The correct answers are A, B, C, D, and E. In most states, statutes or regulations require reporting by physicians, dentists, nurses, and other health care providers, as well as by administrators of hospitals, clinics, nursing homes, and schools. Some states require reporting from laboratory directors, and some even require reporting from anyone with knowledge of a person with a notifiable disease.

    Reference: page 303

12. The correct answer is A. Regardless of the disease, reporting should proceed through channels. The county health department will notify the state health department who may notify CDC who will notify the World Health Organization. The seriousness of the disease may influence how rapidly these communications take place, but should not influence the sequence.

    Reference: page 305

13. The correct answer is B. Active surveillance refers to the health department taking the initiative to contact health care providers to solicit case reports. The contrast is a passive surveillance system, in which health care providers are expected to submit case reports to the health department without ongoing stimulation.

    Reference: page 305

14. The correct answers are A, B, D, and E. Analysis by time often includes comparisons with previous weeks and previous years. Analysis by place can include analysis of both numbers and rates. Routine analysis by person may include age and sex, or race, but the three-variable table of age by race by sex is too much stratification for routine analysis.

    Reference: pages 311–315

15. The correct answers are A, B, C, D, and E. An increase in case reports one week may represent a true epidemic. However, the increase may also represent an increase in the denominator (e.g., from an influx of tourists, migrant workers, students); reporting of cases in a batch, particularly after the holiday season; duplicate reports of the same case; computer errors; a new clinic or physician who specializes in the disease in question or simply is more conscientious about reporting; or other sudden changes in the surveillance system.

    Reference: page 316

16. The correct answer is B. The *primary* purpose of preparing and distributing a surveillance report is to provide timely information about disease occurrence to those who need to know in the community. The report may also serve to motivate and inform those in the community about health department activities and public health issues of a more global nature.

    Reference: page 316

17. The correct answer is D. The minimum number of cases necessary to spark health department action is variable, depending on the disease. For uncommon, potentially fatal diseases such as cholera or plague, even one case is sufficient. For diseases that are transmitted from an animal host such as rabies, presence of rabies in animals near residences may spark health department programs such as public warnings, even if no cases have yet occurred in humans.

    Reference: page 317

18. The correct answer is D. First and foremost, a surveillance system should serve a useful public health function. If the system is not useful (or is not being used), it does not matter whether it is efficient, cost-effective, or directed to an important problem.

    Reference: page 319

19. The correct answers are A, B, C, D, and E. Importance of a disease includes its current impact in the community (incidence, severity, cost, etc.), its potential for spread, and its preventability.

    Reference: page 319

20. The correct answer is C. Sensitivity refers to the ability of a system to identify cases that occur. Specificity refers to the system's ability to exclude non-cases. Predictive value positive is the proportion of persons labeled as cases who truly have the disease. Representativeness refers to lack of bias in the system.

    Reference: pages 322

21. The correct answer is D. The Council of State and Territorial Epidemiologists (CSTE) has developed standard case definitions, listed in Appendix C.

    Reference: pages 302, 325

22. The correct answer is C. Surveillance can be justified if a disease is new and data are needed to learn more about its pattern of occurrence, clinical spectrum, risk groups, and potential for intervention.

    Reference: page 328

23. The correct answer is B. The primary distinction between a surveillance system and a survey is that a surveillance system is ongoing; a survey is a snapshot in time. Both are commonly population-based. Often both collect confidential data. A survey is usually more expensive to conduct, since it requires considerably more effort over a short period of time.

    Reference: pages 328

24. The correct answer is B.

    Reference: page 326

25. The correct answers are A, B, C, and D.

    Reference: page 330

Self-Assessment Quiz 6 – Answers

1. The correct answers are A and B. Most outbreaks come to the attention of health authorities because an alert clinician or an affected patient calls. The other methods listed above occasionally detect outbreaks, but less frequently.

   Reference: page 348

2. The correct answer is C. For an outbreak with an unknown source and mode of transmission, we must first investigate to identify the source and/or mode. Once we have learned source or mode, we can take appropriate control and prevention actions.

   Reference: page 349

3. The correct answer is D. The first step is preparing for field work, which includes discussing what each person's role will be. (It is usually a good idea to designate only one person as the "official spokesperson" for the investigation.) Next we confirm the existence of an epidemic, e.g, confirm that the number of cases exceeds the expected number. In step 3 we verify the diagnosis. In step 4 we define and identify cases, usually by actively seeking additional cases. In step 5 we conduct descriptive epidemiology of the cases, analyzing the data by time, place, and person. By now we should have enough clues to generate reasonable, testable hypotheses (step 6), which we can test with a case-control study (step 7).

   Reference: page 353

4. The correct answers are A, B, D, and E. The first step of an outbreak investigation is preparing for field work, which includes (1) becoming knowledgeable about the disease and what you need to do, (2) attending to administrative and personal details such as stopping the mail, and (3) making appropriate arrangements with your local contacts. On the other hand, because control measures take precedent over all else, discussing vaccination strategies is also appropriate. Talking to a couple of case-patients is part of Step 3.

   Reference: page 354

5. The correct answer is D. Staff from CDC must be invited to participate in an outbreak investigation. The local health department, not CDC, has responsibility for the health of the community (and will be there long after the CDC consultant departs). The local health department is ultimately in charge, and CDC consultants generally serve in whatever role is requested of them (which may be any of A, B, or C.)

   Reference: page 354

6. The correct answer is D. Most epidemiologists use the terms "outbreak" and "epidemic" interchangeably. However, most epidemiologists use the term "outbreak" rather than "epidemic" during the investigation because "outbreak" causes less anxiety or panic. Some epidemiologists also reserve the term "epidemic" for large outbreaks.

   Reference: page 354

7. The correct answers are B and E (E even more likely than B). The pattern of zero case reports during the traditional Christmas holiday season, followed by a larger than usual number of reports, is consistent with batch processing. In other words, it is likely that the reports sat at the local health department during the holidays, and were forwarded in a large batch after the holidays were over. A less likely but also plausible explanation is change in the denominator during the holiday season. For example, if most of the cases of Disease X come from a major university situated in County B, and all the students left during the holidays, a similar pattern of case reports could result.

   Reference: page 355

8. The correct answers are C and D. Even an investigator without a clinical background should, if possible, see and talk to a patient or two to gain a better understanding of the clinical features of the disease (needed for developing a case definition) and to identify possible exposures that may be responsible for the outbreak.

   Reference: page 357

9. The correct answers are A, B, C, and D. A standard case definition should specify the clinical criteria, as well as restrictions by time, place, and person. (The case definition should NOT include the exposure we are trying to evaluate. If we require that cases be exposed, we guarantee that exposure will be associated with disease in our study, whether or not it is in the community. In other words, disease status and exposure status must be determined independently to avoid bias in our analytic studies.)

   Reference: page 357

10. The correct answer is B. To use resources efficiently, we usually confirm a few cases, then include all others who meet reasonable and compatible case definition. Rarely is it necessary to confirm every case — for some diseases, no reliable laboratory test exists, and for others the laboratory test is expensive or limited in availability. A “loose” case definition is appropriate for surveillance purposes, but not for analytic purposes. Finally, while two or three categories of a case definition may be helpful for some diseases and in some settings, there is no requirement that you always use three categories.

    Reference: pages 358–359

11. The correct answers are A, B, C, and D. Frequently, we contact (by letter or telephone) physician's offices, clinics, hospitals, and laboratories to identify additional cases. Depending on the affected age group, we might also contact day care centers, schools, employers, or nursing homes. Sometime the local media outlets pick up on the story and cooperate with public health authorities in educating or warning the public. Finally, we frequently ask case-patients if they know any persons with the same exposure (if known) or with the same illness. While we could review local morbidity and mortality data from the local hospital and local health department, we could not wait the 2 or 3 years, on average, for the data to be available from NCHS.

    Reference: pages 359-360

12. The correct answer is D. In an outbreak investigation, the *ultimate* purpose of characterizing the outbreak by time, place, and person is to generate testable hypotheses about the source, mode of transmission, risk factors, etc. Doing the descriptive epidemiology is also useful because you provide a comprehensive description of the outbreak and you may identify errors in the data.

    Reference: page 363

13. The correct answers are A and D. The epidemic curve is a graph of number of cases by date of onset of disease. The shape of the curve to date helps us predict the future course of the epidemic. A curve which is still rising indicates that we are still in the midst of the epidemic, and more cases will occur. A curve which is falling or has returned to baseline indicates that the peak of the outbreak is behind us. We can identify a probable period of exposure only if we know the incubation period for the disease.

    Reference: page 365

14. The only correct answer is C. The epidemic curve is a histogram, with number of cases (on the *y*-axis) by date of onset of disease (on the *x*-axis). The time intervals on the *x*-axis should be *between one-eighth and one-third* the *average* incubation period. The time frame should begin with a pre-epidemic period, not with the first case of the epidemic.

    Reference: pages 363–364

15. The correct answer is E. Eight hours (the minimum incubation period) prior to the first case puts us in period #5. Ten to twelve hours (average incubation period) prior to the peak of the epidemic puts us in period #6.

    Reference: page 367

16. The correct answer is E. Since the goal of descriptive epidemiology is to identify patterns of disease in order to generate hypotheses, we tabulate the data in variety of ways. Location of residence and location of daytime activities (employment, school, etc.) are the most common, but if they do not produce any meaningful patterns we can try alternate “place” variables. (Recall the spot map of swimmers who developed shigellosis, page 371.)

    Reference: pages 370–372

17. The correct answers are A, B, C, D, and E. The first hypotheses are usually those we associate with the disease in general, i.e., the usual risk factors. If you don’t know them already, you should review a text or the literature to find out. Early on, we talk to the local health department staff and a few case-patients to find out what they think may be the cause. Finally, the descriptive epidemiology may provide clues both by demonstrating patterns among the majority of cases and by identifying “outliers” — persons who do not fit the pattern. Both can provide important clues.

    Reference: page 374

18. The correct answer is A. If you have no reasonable hypotheses, then proceeding to analytic study such as a case-control or cohort study is likely to be a waste of time. Similarly, if the investigators do not have sufficient evidence to suggest the school dining hall as a possible source, laboratory investigation is likely to be fruitless, too. The investigators should talk to some case-patients again, possibly as a group, to try to identify common features.

    Reference: page 384

19. The correct answer is D. The study is a case-control study, because investigators enrolled children on the basis of whether they had the disease ("cases") or not ("controls"). The following two-by-two table summarizes the data:

	Cases	Controls	Total
Exposed	50	25	75
Unexposed	50	75	125
Total	100	100	200

    We cannot calculate rates or a relative risk from a case-control study, but we can calculate an odds ratio as an *estimate* of the relative risk. The odds ratio is $(50 \times 75) / (25 \times 50)$, which equals 3.0.

    Reference: pages 375–381

20. The correct answer is C. The difference is statistically significant, meaning that the null hypothesis (no difference in mean serum porcelain levels between the two groups) is unlikely to be true. We cannot say anything about a cause-effect relationship just on the basis of a statistical test.

    Reference: page 377

21. The correct answer is E. An odds ratio of 1.5 or 1.8 is a "weakly positive association." A value of 10 is a very strong association. "Not statistically significant at the 0.05 level" means that the p-value is larger than 0.05.

    Reference: pages 375–381

22. The correct answer is E. Because all attendees participated in the study, the study is considered a cohort study, and the appropriate measure of association is the relative risk. The relative risks are calculated as:

    Macaroni salad: 25/40 / 20/59 = 62.5% / 33.9% = 1.8
    Potato salad: 17/55 / 28/44 = 30.9% / 63.6% = 0.5
    Three-bean salad: 43/90 / 2/9 = 47.8% / 22.2% = 2.2
    Punch: 40/92 / 5/7 = 43.5% / 71.4% = 0.6
    Ice cream: 20/21 / 25/78 = 95.2% / 32.1% = 3.0

    Reference: pages 376–377

23. The correct answer is C. Although the highest relative risk is associated with ice cream, that food could explain only 20 of 45 cases. In contrast, three-bean salad was also associated with an elevated relative risk, and could explain all but two of the cases. Those two cases might be attributable to cross-contamination of a serving spoon. Other explanations such as faulty recall are also possible.

    Reference: pages 376–377

24. The correct answer is A. Control measures should be implemented as early as possible. Usually we attempt to verify the diagnosis so we can implement the appropriate control measures. But we can sometimes take action before confirming the specific diagnosis, if we know the source and mode of transmission and know how to control them! Conceptually, control and prevention measures may be Step 9, but in the real world they are our highest priority.

    Reference: page 385

25. The correct answer is D. The first responsibility is to the local authorities. Before the federal investigator leaves town, he/she should provide an oral briefing for local health authorities and persons responsible for implementing control and prevention measures. A written report to local authorities should follow in timely fashion.

    Reference: page 386